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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" June 25, 1979 • VOL.15, NO.1 P.J.McGOVERN, PUBLISHER

Distributed Data Bases Bring Challenges -- page 4

UNIVAC 1100/60 SPANS RANGE OF 1100s TO 1100/80 UNBUNDLED SOFTWARE, COMMUNICATIONS CPU STEAL LIMELIGHT

Amid the carnival atmosphere of this year's record-setting National Computer Conference (page 3), Sperry Univac made its annual new computer announcement. The object of this years breakfast press conference was the Model 1100/60 computer, actually a six-model family that spans a performance range from the 1100/10 to the 1100/80. Superseded are the 1100/10, 20, and 40.

With the system, which Sperry pits against the 4341 and bigger IBM mainframes (up to the 3032), came also:

- Major unbundling. All but the operating system executive has been split out, with prices for software and support ranging from $2,000 a month to $5,000.

- A new communications processor. Called the DCP/40, the system replaces the orginal DCP announced with the company's network architecture (EDP/IR,Nov.12,1976).

- A new high performance disk subsystem offering over 500 MB per drive and a total subsystem capacity over 16 billion bytes.

- Remote hardware maintenance and on-line diagnostics; and a service for operating system support above-and-beyond normal requirements.

As with any new computer announced these days, the 1100/60 has new technology -- in this case a "multiple-microprocessor" architecture and emitter-coupled logic circuitry -- new price/performance ratios, and compatibility with other 1100s. New software provides a data dictionary for data base management and a communications manager that expedites traffic between 1100s and terminals, including V77 minicomputers.

With the 1100/60 announcement Sperry left its Series 90 family alone -- but EDP/IR would not be surprised to soon see unbundling here as well. Not to mention a 4300 competitor. There are also hints that Sperry will dish up a smaller 1100 system in a future announcement to compete with the 4331.

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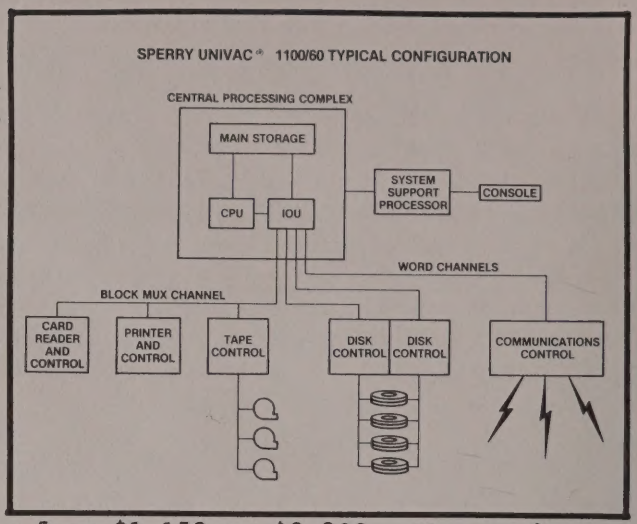
The six CPU 1100/60 models include four uniprocessors and two multiprocessors, each capable of supporting two to four megabytes of main memory per processor.



The performance range, which the company says spans from 2 to 9 times the old 1106, is accomplished by an 8K cache memory on two of the models and an extended instruction set on two of the models. In addition, models can be configured with anywhere from 1-2 CPUs and 1-2 IO units.

Purchase prices range from $319K to $1,442K; monthly maintenance charges from $1,150 to $3,800. Memory increments cost roughly $30,000 a megabyte. First deliveries: next January.

New technology for reliability

The 1100/60 is designed for ease-of-repair. Arithmetic and logic functions are carried out by twin microprocessors, each with a shadow micro that performs the same function on the same data. At the end of each cycle, the micro outputs are compared. A hardwired instruction retry mechanism allows the system to recover from most transient faults.

For more egregious faults, the 1100/60 operating system will bypass the failed component until repair can be made later. A System Support Processor (SSP) is connected to the main computer complex for system control and support for diagnostics and maintenance. Fault detection has been designed to isolate faults to a small area of circuitry -- the card level or smaller -- and Sperry will operate a 24-hour remote diagnostic service for problems beyond onsite capabilities.

And hotshot peripherals

Along with the 1100/60 Sperry announced new peripherals, including a new mag tape subsystem and a new 1200 lpm impact printer. But the most exciting introductions were the:

- 8470 Disk Subsystem, which provides 125 million 36-bit words of moving head storage per drive and a fixed head option of 338.7K words. The system has an average latency of 8.3 milleseconds; a data throughput of 2.1 megabytes/second. One control unit and one disk drive costs $87,200.

- The DCP/40 communications processor, which can be used as either a computer front end, remote intelligent concentrator, or nodal processor. The DCP/40, which will cost from $100K-$300K, can handle up to 256 lines, support up to 2 MB of storage, and run on both 1100 and Series 90 computers.

And thus Sperry continues the steady unruffled evolution of its 1100 line, now close to 1,100 units strong, according to EDP/IR's worldwide count.

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NCC DRAWS A RECORD CROWD IN NEW YORK CITY
AS NEW PRODUCTS, ENHANCEMENTS, ETC. BOMBARD NEARLY 80,000 ATTENDEES

If you were there then you know: the computer industry's annual self-thrown party is just getting too big. The hustle and bustle of 80,000 people trooping through four floors of the New York Coliseum and the exhibition halls of nearby hotels soon becomes din, the senses soon overload.

So much so that at first it seemed that nothing really happened (unless you're into 8" Winchesters, backup tape systems, etc.) that didn't have to do with the personal computer exhibit. But in retrospect, a lot of new products were announced. It's impossible to list them all, but some that EDP/IR feels ought to be rescued from the shuffle:

... Honeywell's new Page Processor II, which can be attached online to an IBM host and run at 19,000 pages per second ... also Burroughs' new 9270-35 Page Printer, a computer-based xerographic/laser device that also operates offline at 18,000 lines a minute.

... Fujitsu's new 32 KB bubble memory cards, also the firm's three new Winchester fast-access disk drives.

... new small business systems from "dumb" terminal makers ADDS (the Vanguard System) and Lear Siegler (1000/4 and /8 Data Systems).

... diskette storage for the Dataspeed 40 and other terminals from AT&T, called Comm-Stor II and made by Sykes Datatronics.

... speaking of Ma Bell, Teletype announced a new 2740-type remote, interactive keyboard-based terminal, the 4520.

... General Automation's Hypak memory: $15,000 per board (1MB).

... from other minimakers: a new family from Harris, called the S800s, two new DS990 minis from Texas Instruments, 3270 support software from Tandem.

... an "intelligent line adapter" for Memorex's old (1970) 1270 terminal control unit that adds capability to the non-programmable hard-wired front end.

... the Four-Phase answer to the IBM 8100, the System IV/65.

... a word processing connection for Xerox's 9700 printer.

... a $6,000 Pascal system based on a Western Digital single-board computer and marketed by Pertec.

And many more. All of which serve to illustrate the marketing man's dilemma: whether to introduce a product at NCC or not. There are certainly people there to see and hear the pitch . . . but will they?

OVERHEAD ON THE FLOOR: Pertec's Ralph Gabai calling his company's 8" disk a "mini-wini," referring to it as the real "piccolo," IBM's codename for a bigger version he says should be monikered "bassoon."

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Thumbnail tutorial

DISTRIBUTED DATA BASES CREATE NEW CHALLENGES AS RESEARCHERS LOOK FOR WAYS TO INCREASE DATA ACCURACY

The two most inexorable trends in EDP during the last decade have probably been the twin thrusts toward data base management and distributed data processing. Unfortunately, the two do not go together exactly like "love and marriage." Data base management systems (DBMS) best lend themselves to data files stored in once place ... distributed processing (DDP) just the opposite.

And combining the two, in distributed data bases, simply adds another layer of complexity to managing data. Two particular problems are:

- Concurrency control -- making sure that all the data in duplicated data files are up-to-date and yet accessible to all transactions.

- Robustness -- preventing the failure of one node or transmission link from degrading the total system.

Centralized data base systems have enough trouble dealing with these two problems; distributing data across a number of sites via communications links makes control even worse, since one site can't know what's going on at another at all times.

But since these two trends are close to inexorable, the marrying of DBMS concepts to DDP will be a crucial milestone in bringing computer power closer to the source of its demand. Thus, there is a need for solutions, which, if the sessions at the recent NCC are any indication, are finally coming along. There is also a need then, for members of the EDP community to understand their nature . . . a whole new set of buzzwords is developing as one more new wave of computing leaves the researcher's alcove and heads for leading-edge user sites.

Tackling concurrency

The purpose of "concurrency control" is to synchronize concurrent interactions with the data base so that each reads and/or writes consistent data and also runs to completion. One traditional approach has been "locking" -- where each transaction controls the data sets it needs (i.e. prevents other transactions from altering data elements). If a transaction needs access to data sets that another transaction has "set a lock" on, it must wait until the first transaction is done.

Simple enough. But "locking" has its drawbacks, primarily in the overhead of transactions waiting for data to be released by other transactions. And in distributed data bases, another problem crops up -- "deadlocking" where transactions end up waiting for each other's data sets. Detecting such "deadlocks" requires communications between nodes at which transactions are generated; preventing them requires some sort of algorithm to abort and restart one of the deadlocked transactions.

(Gerald Popek of USCA, on leave to Xerox, mentioned in a recent NCC session a locking protocol that costs three messages per transaction to every site in the network.)

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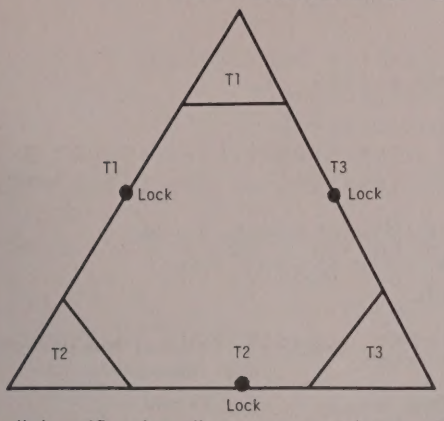
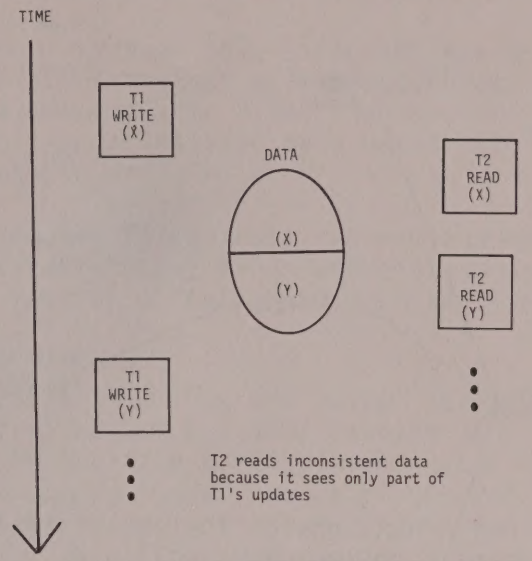
TWO PROBLEMS OF DISTRIBUTED DATA BASE CONTROL



In "deadlocks," transactions find themselves waiting for data under "lock" by transactions also waiting for data under lock. If the queue forms a closed loop, all transactions end up stymied . . . and a protocol must be used to restart the transactions.



Read-only transactions must also follow "locking," or else they can read inconsistent data.

According to Philip Berstein and Nathan Goodman of Harvard, there are three basic methods of concurrency control for distributed data bases:

- Locking -- described above, which can be controlled from a central site (as with centralized data bases) or distributed across the network's nodes. In the former, the primary site can easily become a bottleneck for the whole distributed network; in the latter detecting deadlocks becomes much harder.

- Majority consensus -- an algorithm designed by Robert Thomas of Bolt, Beranek and Newman for fully redundant data bases, where each site has a stored copy of every logical data element in the data base. Each transaction uses its local data base and writes to an update file. At the end of the transaction, the update file is sent to each site in the system. Conflicting transactions are then weeded out or corrected by a complex method of comparing times of data modification and times of transaction usage.

- The SDD-1 approach -- a method being developed for the Defense Department by the Computer Corporation of America. Unlike the former methods, SDD-1 does not resolve all conflicting read/write commands, since not all conflicts lead to a violation of the data base. SDD-1 operates by lumping transactions into classes and only worrying about conflicts between classes. It also uses "timestamp-based protocols" in resolving conflicts.

The advantages and disadvantages of each of these methods are not exactly comparable. Locking is simple and communications overhead will be lower when control is distributed across the network's nodes; majority consensus cuts communications overhead by, in effect, sending all lock requests in a single message (at the risk of multiple restarts); and SDD-1 can be tuned to the specific applications running on the network.

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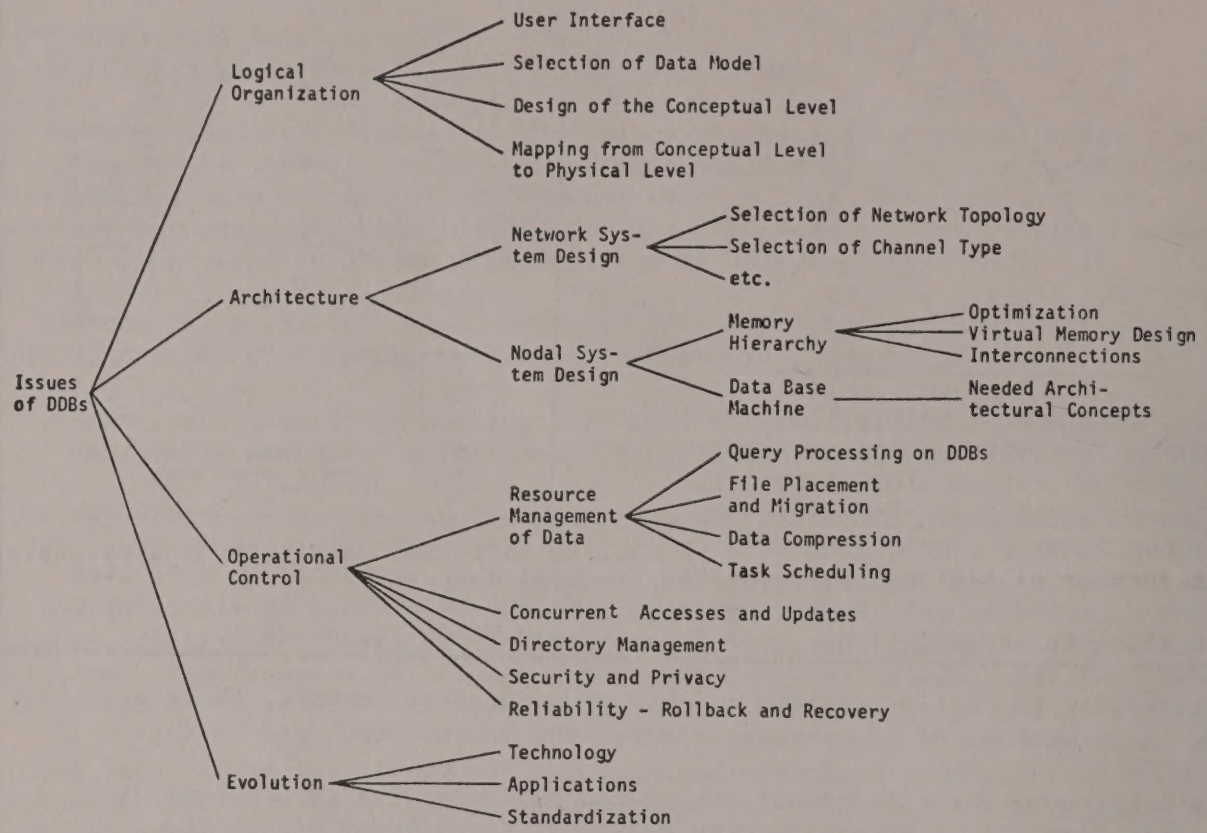
DISTRIBUTED DATA BASES: THE MACROCOSM



There are many issues involved in designing distributed data bases as this chart from a paper by C.V. Ramamoorthy and B. W. Wah in the 1979 NCC proceedings shows. "Concurrency" and "robustness" are but one branch of the tree of operational control. Marrying DDP to DBMS is indeed a complicated affair.

(There is also the option of ignoring conflicts and proceeding without locking devices . . . based on a presumption that very few conflicts will actually occur compared to the number or transactions. IBMer Jim Gray, who spoke at an NCC session, observed that this seemed to work well in centralized DBMS. IBM's CICS, for example, has no locking mechanism.)

Providing "robustness"

Once a system has been devised that works properly when all its parts are intact, the question of "robustness" arises. How sound is the system when one or more of its parts (nodes) are down?

In distributed data base management systems, a practical concurrency controller must operate in the face of three types of problems:

1) A failed site may hold stored copies of data being updated,

2) A failed site may hold synchronization information, and

3) A transaction updating data at several sites may fail before it has updated all sites.

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OPERATING SYSTEMS VERSUS DATA BASE MANAGERS -- TRUCE IN SIGHT?

Operating systems and data base management systems have different needs and functions . . . and thus their interaction cannot be all things to all people. But signs evident at the sessions of this year's NCC indicate that a truce might be forthcoming in the wave of new relational data bases hitting the field and on the drawing boards.

(The basic problem: operating systems do not "like" data records and have simple files, DBMS systems are built to store records, their attributes, and a detail of the activity concerning those records. Thus their architectures are quite different.)

Take Unix, the Bell System operating system. Under a new system developed by Bell Labs called the Unity DBMS, operating system and DBMS features are combined for interactive users. Unity is essentially a relational system that has commands at the shell level, table definition, index for attributes of a table and relational "operators" such as select, project columns, join tables, etc. In addition, it can perform updates on data files and perform data analysis such as statistics, distribution, and tallies.

Unity runs under Unix on the PDP-11/70 and LSI 11; and Bell Labs is exploring putting it into a star configuration with a PDP-11/70 as the hub and LSI-11s as nodes.

Another suggestion, from Ehud Gudes of Penn State, is to provide the operating system and the DBMS with a common kernel of software that manipulates common objects . . . objects can be files, records, relations, attributes, or sets of attributes. They can be either physical (a storage block on a storage device) or logical (a single attribute type).

The operating system and the DBMS would thus be on a par with each other . . . having a uniform approach since they would deal only with objects.

According to Berstein and Goodman, "no mechanism yet developed attains 100% robustness and it is believed no mechanism is possible." But mechanisms have been proposed that would provide certain degrees of robustness . . . mostly through the use of backup logs and buffered update files. The alternative -- and not a totally unsatisfactory one -- is the simple aborting of all failed transactions.

The "distributed" syndrome

All of the problems and solutions mentioned are endemic to centralized data base management . . . distributing the data simply makes them worse and adds new wrinkles. And in distributed data bases, the question of performance boils down to communications performance. Few votes are in yet on these nascent techniques for dealing with distributed data bases, but a third factor that may greatly influence performance must also be kept in mind by students of the techniques: hardware technology.

As memory gets cheaper, node storage more plentiful, and communications networks more amenable to data, the option of backup files and logs becomes less costly. Cheap circuitry and memory may indeed be the ultimate lubricant between the frictive forces of DBMS and DDP.

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• SANDERS BIDS FOR 37% OF CALCOMP. Didn't take long to dissolve the domain that took several years to build. Looks as if the last piece, the graphics products, is on the block with Sanders as the bidder. Calcomp shareholders are asked to approve the sale of 37% or 1.26 million outstanding Calcomp shares for $13.50/share to a Sanders subsidiary. Another deal pending is the sale of Calcomp's plug compatible memory business and most of its service force to Braegen. The floppies went to Billings and the hard disks to Xerox. The Braegen deal is a bit ironic, as Calcomp was once headed toward acquiring none other than Braegen. The head of Braegen is Darryl McCullough, a former Calcomp exec.

• XEROX PUTS MEMORY PRODUCT PIECES TOGETHER in Xerox Memory Systems, an organization that reports to the Information Products Group. XMS includes Shugart, Century Data (formerly the hard disk portion of Calcomp) and Xerox Magnetics, a new unit that will make rigid disk media for Xerox' internal needs. Donald J. Massero, formerly president of Shugart, heads XMS. Interestingly, Diablo is not part of XMS as disks are not its major product line. But strategic planning of disks by XMS will pertain to Diablo.

• PROGRESS CONTINUES IN MEMORY AREA with a dry semiconductor manufacturing process from Motorola called plasma developable photoresist (PDP) and larger bubble units -- a 128K byte chip from Intel and an onboard controller that handles up to 1 Mbyte of bubble. All this promises lower prices in the future. Motorola expects the PDP process, which it plans to implement on some product lines this year, to reduce costs substantially as it nearly eliminates need for environmental controls such as deionized water, acids, solvents and developers. Intel's 128K bubble and prototype kit that includes associated electronics but not the controller costs $2,280.

• HONEYWELL PROVIDES CP-V USERS UPWARD PATH in the form of the Series 60, Level 66/DPS/B3, which has power in the mid-range of the Xerox CP-V user base and is intended as an upgrade for the Sigma 6, 7 and 560 CP-V users. HIS is developing the CP-6 operating system that reportedly will ease the transition to the hardware. Shipment is scheduled for first quarter, 1980.

• CRAY SETS UP RESEARCH SUBSIDIARY that will be based in Colorado under the direction of G. Stuart Patterson Jr., former head of a facility at the National Center for Atmospheric Research. Work on Cray-2 will continue at Chippewa Falls, Wis. The move indicates there will be more products down the pike after the Cray-2.

• TWO-PI SYSTEMS HEAD FOR AUSTRALIA under an OEM contract with Semiconductor Systems, Pty, Ltd. for over 100 V32s. The first system is headed for CSIRO, Sidney, a government installation. And the Two-Pi system marketed by NCSS, the 3200, is attracting outside software in the form of a version of Ramis II from Mathematica Products Group.

• IBM SPEEDS UP INK JET PRINTER AND CHANGES charging methods to a monthly lease and rental charge plus a per sheet charge beginning Oct. 1. The per sheet fee applies to new orders of both the old and new model of the printer. Users with the 6640 installed may maintain their current pricing plan through Aug. 1, 1981 or their base term. The top speed on the 6640 is now 184 char./sec vs 92 and it offers seven fonts vs. five.

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REVIEW & FORECAST

EDP industry report

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"THE GRAY SHEET" June 29, 1979 • VOL.15,NO.2&3 P.J.McGOVERN,PUBLISHER

Recession resistance?

1978 AND FIRST HALF OF 1979 MEET OR EXCEED FORECASTS

After three successive years of more than 17% annual growth, computer shipments will increase only 11% during 1979 and continue at the 11%-to-12% rate each year into the middle 1980s. Other sectors will do even better.

Does this suggest a spending downturn? For 1979, perhaps, although the trend toward purchase continues. More significant: 1) Substantially more processing power is continually available for the dollar; 2) the trend toward distributed processing involves terminal and datacomm equipment, gear that IDC doesn't add into the computer shipment figure being considered here -- the $18.8 billion for 1979 that is expected to grow to $34.4 billion in 1983.

One of the big questions these days is whether or not a recession is expected. Indeed, triggered by events such as escalating oil prices, recession may be a self-fulfilling prophesy. But at the National Computer Conference earlier this month, there was evidence only of happy days.

A picture of boom times bubbled forth, all records were broken. More than 66,000 attendees traipsed through four floors of the New York Coliseum, one floor of overflow exhibits at the Hilton, and another floor of personal computer exhibits at the Sheraton Center (nee Americana). Exhibitors generally assessed the crowd as knowledgeable and interested in buying.

In general, elasticity of the marketplace appears to be the overriding observation -- from NCC and for the entire information processing industry. And closely related, is productivity. New products continue to offer new or better performance -- at the same or lower prices. And with each technological advance or price/performance break a new level of user seems ready to invest in productive equipment.

All the mainframers except DEC have dramatically increased price/performance ratios with new lines of products and price reductions, especially in the memory area. Terminal makers are incredulous at the demand; a couple say their 30% annual production increase is inadequate to meet orders.

Indeed, the past 18 months have seen many trends grow stronger, and some realities emerge from concepts. Specifically:

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- Mainframers improved the price/performance of their products and nearly all introduced new families of processors. Better price/performance ratios stem in part from higher density memories (usually 16K-bit chips). More microcode is common as is the use of cache memory. Systems generally require less power, thus reducing the costs of operation.

- Separate pricing of software. IBM partially unbundled its operating software on the 4300s and Univac separately prices applications software on its new 1100/60. This tends to exaggerate the improvement in hardware price/performance and to complicate comparisons of systems.

- Easier-to-use systems through query languages, easier screen formatting capabilities, and friendly data base management systems.

- The plug-compatible CPU continued to come into its own with more vendors joining the fray, many of them services companies. But the expectation of and then the announcement of the IBM 4300 seems to have cast a temporary pall on some orders. Now the PCM makers emphasize prompt shipments as IBM delivery schedules stretch into the early 1980s.

- Distributed processing, although still elusively defined, seems to be more of a reality than a concept -- a change from a year and a half ago. Now it's up to the software types to provide solutions to problems such as concurrency and robustness when data bases are scattered.

- There is distribution of intelligence within the CPU. Designers have discovered that microprocessors at various points such as the I/O can improve performance.

- Communications took some large leaps forward, thanks in part to the emphasis accompanying distributed processing.

  + Nearly all mainframers' networking offerings promise X.25 compatibility, although not all offer X.25 at the moment. Such a trend indicates recognition that parochialism, although tending to lock users in, just isn't the wave of the future. Univac's new Distributed Communications Processor, the DCP/40, handles X.25 and can be adapted for use with other makes of CPUs, Univac said at the NCC announcement.

  + Ability to communicate with IBM systems is becoming more prevalent as mainframers, minimakers and key-to-disk vendors alike endow their terminals with this feature.

  + There will be no dearth of choices of communications networks. AT&T's Advanced Communications Service (ACS) for the small to medium user; Xerox's Xten for the mid-size user and IBM's Satellite Business System (SBS) for the large corporation.

  + The Federal Communications Commission is making competition the byword. AT&T is finding others in its long distance arena: MCI,

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Southern Pacific et al have gained that right after some battles in court. Lately, Computer Inquiry II has proposed a hybrid category that obviates the need to clearly define (regulated) communications and (unregulated) DP boundaries.

- The antitrust arena continues without many waves. The Memorex case concluded, Transamerica took its turn at bat and should conclude shortly, Greyhound is getting ready to try again, and CalComp got shot down on appeal. Meanwhile, U.S. vs. IBM marks its tenth year since filing, and drones on. But now IBM is giving its defense.

- The Federal government adopted the proposed channel level I/O interface standard in its procurement policies.

General purpose computers

The annual increases in value of shipments for general purpose computers will show a smaller rate of growth after 1979 because of the bulge from 303X shipments and the correspondingly larger size of the base. For instance, the annual increment in dollar value of worldwide shipments from 1978 to 1979 was 16.1%, whereas it is expected to be 7.2% from 1979 to 1980. Recovering from the 50% and above levels of 1970-1974, retirements as a percentage of shipments hit a low of 22% in 1978. This ratio is expected to hit 30% in 1979 and it should increase to 35% by the middle 1980s.

Perhaps IBM's biggest move has been to enter the field of distributed processing (IBM has started talking about "cooperative network processing") via the 8100 and later with the 4300. It has also made SNA less exclusive. Now, through such means as the newer S/1 and other devices, users can link their older terminals to an SNA net.

WORLDWIDE GENERAL-PURPOSE COMPUTER MARKET FOR U.S.-BASED MANUFACTURERS
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	1978 Shipments		In Use Yearend 1978		
	$M	% Total	$B	% Total	1977-78 Change
IBM	$9,525	66.6%			
PC Peripherals	700	4.9			
Itel	350	2.5			
Amdahl	315	2.2			
Total IBM Base	10,890	76.2	$64.3	72.4%	+ 17.1%
Sperry Univac	950	6.6	6.6	7.4	+ 13.8
HIS + Xerox	820	5.7	7.0	7.9	+ 11.1
Burroughs	750	5.3	5.0	5.6	+ 13.6
CDC	340	2.4	2.9	3.2	+ 11.5
NCR	320	2.2	1.9	2.2	+ 8.0
DEC	190	1.3	0.8	0.9	+ 33.3
Others	40	0.3	0.4	0.4	+ 25.0
TOTAL	$14,300	100.0%	$88.9	100.0%	+ 14.3

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Also, IBM set the world on its ear a couple of times with memory prices, and let loose a clear signal that its laboratories have been productive. There is awesome technology behind IBM's 64K memory, and its capability to design and fabricate this type of memory and dense logic chips. Memory suppliers are still quaking after the last volley, which priced memory on the 4300 at 15 cents/byte. Other mainframers have suddenly dropped their memory prices also, as have some minimakers.

On the small systems front, GSD has been active, with perhaps the most notable product being the System/38 that has one-level memory management and an integrated relational data base management system that looks like big brother's experimental System R.

Univac tied tighter the link between it and its minicomputer area, formerly Varian, via software. But it waited until NCC to unveil its answer to increased price/performance, the 1100/60 line. With five uniprocessor and two multiprocessor models that succeed all other models of the 1100 family except the top of the line 1100/80, the 1100/60 establishes a lower entry level price into the 1100 line, with performance starting at that of a 4331 and ranging up into the 303X area. Univac indicated it intends to help users cross the span between the 90 and 1100 series via compatible peripherals and compilers.

Control Data, not about to let Cray walk away with the only really big number cruncher, unveiled its answer, the Cyber 270. It expanded its range of Omegas for the IBM-compatible trade with the 480-III and cut prices on its I and II. CDC managed a whopping 105% rise in earnings from its computer operations during 1978 -- which includes its services offerings and sales of OEM and IBM-compatible peripherals. In the process, CDC continued its policy of spanning the globe for business and being vociferous about the U.S. constraints to trade in the DP area.

Burroughs had some trouble delivering its B 7800, which incorporated advanced logic techniques, but did manage to ship one to Japan. In other areas, it jumped into the price/performance game with the first models of its B 900 series, the B 2930 and B 3950. The Motown maker's range of new modular terminals -- small and designed for specific uses -- seems designed to give NCR some competition.

Honeywell revamped its current lines to conform with others' price specs, creating two smaller Level 66s, the DPS 440 and 520. Two Level 64s, the DPS 320 and 350, are priced below the previous bottom of the line. HIS also is upgrading models available to its Xerox base, enhancing its minis as well as its mainframes, and endowing both its Xerox and HIS mainframes with updated operating systems.

With its acquisition of Incoterm, HIS indicated it too is interested in courting specific industry markets, as exemplified in its recent announcement for the manufacturing segment. Furthermore, the combination of Incoterm controllers and terminals and the Level/6 mini should give HIS a range of offerings in distributed environs.

NCR's 85X5 -- the V8455, V8555M, V8575M and V8585M -- succeed the V8500 models and can become multiple processor systems with other members of the family. The NCR family appears to sit aggressively on the price/performance curve charted by IBM's 4300s.

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Minis growing up

With the growth of the supermini, and the user's desire to add goodies onto a bare mini, IDC has revised downward its estimate of the number of minis shipped and increased the average value of equipment shipped. The number of minis shipped worldwide is expected to more than double over the next five years, from 100,000 in 1978 to 235,000 in 1983. Meanwhile, the value of these shipments will more than triple, from $3.1 billion in 1978 to $10.3 billion in 1983. The value of the installed base worldwide should more than quadruple during the next five years while the number more than doubles.

Superminis should continue to account for about 41% of the value of U.S. shipments and 9% of the units, while the value of micro shipments by these makers should double to 12% by 1982.

Mini manufacturers have been actively marketing to the end user to offload central processors and also to fit into distributed processing schemes. Meanwhile, they have been busy fortifying their newfound preserve of the end user by adding some sophisticated networking capabilities that in some cases rival or outdo mainframe offerings. A few instances of the new networks are Primenet, Tandem's Access, and Computer Automation's Virtual net, all of which support X.25.

This end-user market means possible mainframe competition. As a shelter, the suppliers have found they must make a higher level of commitment to software. If the minimakers can provide adequate, easy to use software with such goodies as data base management systems and data dictionaries, as well as industry-specific software packages, they should have some protective armor.

WORLDWIDE MINICOMPUTER MARKET ACTIVITY

	$M Revenues			Units Shipped		
	1977	1978	% Share	1977	1978	% Share
Digital Equipment	1100	1420	39	37,500	47,500	47
Hewlett-Packard	390	535	15	6,000	8,000	8
Data General	279	410	11	11,600	12,900	13
HIS	130	200	5	1,600	2,000	2
Perkin-Elmer	86	113	3	2,000	2,100	2
General Automation	83	111	3	2,650	2,600	3
Texas Instruments	80	110	3	5,000	6,000	6
Prime	50	94	3	626	670	1
IBM	30	80	2	1,150	2,800	3
Microdata	38	76	2	996	1,380	1
Computer Automation	52	68	2	5,228	6,000	6
ModComp	54	65	2	703	800	1
SEL	35	50	1	165	300	neg.
Harris	32	40	1	235	300	neg.
Univac	36	38	1	1,200	1,050	1
Tandem	11	31	1	76	90	neg.
Others	174	209	6	5,271	5,510	6
TOTAL	$2,660	$3,650	100%	82,000	100,000	100%

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Mini makers are attempting to protect their low-cost flank as well and in many cases have micro-based systems on the market to do battle with offerings from the semiconductor vendors. Most likely the real battleground between the mini makers and the semi houses will be in the small business field, where often a couple of micros comprise the guts of a system. Minis also face potential competition, at least at the OEM level, from terminal vendors who are incorporating micros into the terminals themselves rather than using minis as the force behind clustered processing terminals. Minimakers trying to retain this business are making their systems easy for the OEM to program. In addition, they are starting to supply such goodies as data base management systems and data dictionaries.

Minis are becoming an increasingly important part of mainframers' product lines and are proving valuable marketing tools. Honeywell has probably done as good a job if not better than any other vendor in using its minis to land sales of larger processors for distributed processing. Univac is showing signs of bringing its Varian acquisition into the fold, while IBM's General Systems Division is still trying to do its own thing (i.e. be a mini vendor) with the Series/1.

Some idea of the growing importance of the mini mart to the overall industry can be gleaned when one considers that the value of worldwide mini shipments in 1974 was less than one-tenth that of general purpose computers and in 1978 was about one quarter. In 1983, the value of minis shipped should be about one-third that of the general purpose computers.

The small business market

Just as hot and perhaps more widely talked about is the small business computer business. Up 35% in 1978, shipments this year are estimated to be ahead another 21%, topping $2 billion for U.S.-based manufacturers worldwide.

Three types of vendors -- mainframers, minimakers, and independents -- use a variety of marketing approaches to go after the nearly 500,000 business establishments that are the target. In addition to a sales force, the suppliers use distributors, systems houses, service bureaus, and retail stores to hawk their wares. Radio and TV ads supplement regional trade shows and trade publication advertising.

With about 13,000 unit shipments in 1978, IBM took 32% of the small business computer market. Wang was second with some 6,000 shipments, followed by Burroughs (4,280), DEC (3,250), NCR (1,900), and Basic Four (1,500). The other 10,000 systems shipped were supplied by more than 60 different types of organizations.

Terminals are booming

The terminal market is divided into several sectors -- each with its own growth pattern, and all of which are contributing to the trend toward making terminals omnipresent. The largest sector is the U.S. general purpose data entry/terminal equipment market, which should more than double in the next five years from the 1978 base of 2.27 million units installed to 5.07 million in 1983. IBM holds the largest share, with 26.7% of the installed base, which includes CRTs, keyboard/printers, and machine-oriented devices such as OCR and remote-batch terminals.

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Makers of conversational (dumb) CRTs claimed a record year in 1978, with many shipping 20,000 to 40,000 terminals. The U.S. installed base at year end was 278,700 units. The U.S. editing CRT terminal market, with 494,000 of IBM 3270-type devices installed at the end of the year, shows IBM's share of the market has been decreasing -- to 52.4% at the end of the year.

But IBM, with its 3278, became more competitive. Delays in deliveries -- only between 7,000 and 8,000 were shipped -- prevented the new version from having more of an impact on the market. Those vendors whose products have the IBM's communications scheme -- synchronous data link control (SDLC) -- will have an edge on the other independents.

In the processing terminal arena, most of the growth potential lies in the clustered approach rather than single stations. One reason why the single station area is still growing is the number of new entrants with their intelligent terminals. The clustered approach is slated for high growth -- 37% a year -- thanks in part to the fact the IBM 8100 is included in this category. At yearend 1978, Four Phase and Datapoint were fighting for supremacy with a 32% and 30% share of the market, respectively.

The application-unique terminal market should grow at about 20%/year, more than doubling from 780,000 devices in 1978 to 1.8 million in 1983. The source data entry sector should show the most growth, whereas the stock quotation market is reaching saturation and the retail sector should decline slightly due to retirement of some credit authorization devices (that function can be done by newer POS systems.) Examples of sectors using source data entry are manufacturing, sales reporting and betting and gaming.

Services growing with CPUs

The services sector expanded on the old adage "if you can't beat 'em join 'em" with vigor. At least four companies announced offerings that presented the user with his own onsite system, frequently hooking into the service's facilities if needed.

Revenues of U.S. suppliers of processing services should grow at a compound rate of 17% through 1983, when the total will reach $10.7 billion, led by a 24% compound growth in the remote autotransaction sector. Meantime, carry-in batch will merely grow at a compound rate of 7%, but will still be nearly the size of remote problem-solving, which is slated to grow at 20%.

Firms entering into the hardware territory often based their equipment selection on compatibility of software with their own software offerings. National CSS elected Two Pi because its its Nomad data base system and its operating system are fine tuned to run on IBM-type products. And ADP, a DEC-based house, chose the DECsystem 2020 as its representative. Although there are slight differences in whether they sell or lease their systems, the fact remains their value added lies in their software expertise.

Services firms discovered the acquisition game, and played it with a vengeance. Many bought specialty houses while some also grabbed at smaller, formerly batch-oriented shops, and tried to bring them into the world of online. Itel, notable for its past acquisitions, has been quietly dumping some of its efforts in this field lately. But the trend is there -- the big get bigger and the small get bought out.

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MARKET FOR PROCESSING SERVICES
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$ Million	Carry-In Batch	Remote Batch	Interactive
Problem Solving	$60/(-6%)	$505/21%	$770/18%
Transaction Processing	$1,995/7%	$555/30%	$530/17%
Data Base Inquiry	$45/8%	$17/19%	$438/25%

The number of vendors reaping more than $100 million in revenues grew from eight last year to 10: CDC, CSC, ADP, EDS, GE, SDC, McAuto, Tymshare, PRC, and Bradford. Informatics was almost there with $92.5 million. Of course, the number of participants in the U.S. services industry adds up to nearly 3,000 organizations.

Although IBM is now allowed to compete in the services market, it has been remarkably quiet about its plans, if any. EDP/IR suspects we will see IBM in the services sector in conjunction with its Satellite Business Systems offspring.

Software sales no slouch

Prompted by the scarcity of good people, worldwide revenues of U.S.-based suppliers of independent packaged software should rise by a hefty compound annual rate of 28% through 1983, when the total revenues should reach $2.3 billion from its 1978 base of $670 million. Applications packages, with a 31% growth, will outpace the systems and utility sectors, and grow from 48% share of the pie to 55% in 1983.

In the software field, there were 14 suppliers whose revenues exceeded $10 million. Only two vendors, UCC and Informatics, are active in all three segments of the business.

INDEPENDENT PACKAGED SOFTWARE REVENUES
(Copyright 1979 by International Data Corporation)

Type	1978	% Per Yr.	1983
Systems	$102M	16%	$ 218M
Utility	243	27	806
Application	325	31	1,276
TOTAL	$670M	28%	$2,300M

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COMPUTER MARKET SUMMARY (U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	67,850	264,690	$ 12,000	$ 58.5
1975	71,900	323,740	12,250	67.1
1976	92,040	392,830	13,300	76.6
1977	128,470	496,760	16,000	89.0
1978	144,410	619,320	18,800	104.2
1979	168,800	764,400	22,250	120.9
1980	204,500	932,600	24,700	139.2
1981	246,600	1,133,500	27,600	159.6
1982	292,800	1,377,200	30,850	182.4
1983	340,100	1,663,400	34,350	208.1
		UNITED STATES		
1974	46,300	171,240	$ 7,100	$ 33.3
1975	48,300	208,640	6,650	37.8
1976	61,240	253,580	7,100	43.3
1977	87,580	322,320	8,900	50.3
1978	96,540	401,460	10,300	58.6
1979	111,200	492,200	12,150	67.7
1980	132,500	596,100	13,500	77.7
1981	159,500	720,500	15,150	88.8
1982	187,800	870,200	16,950	101.2
1983	218,500	1,046,800	18,950	115.3
		INTERNATIONAL		
1974	21,550	93,450	$ 4,900	$ 25.2
1975	23,600	115,100	5,600	29.3
1976	30,800	139,250	6,200	33.3
1977	40,890	174,440	7,100	38.7
1978	47,870	217,860	8,500	45.6
1979	57,600	272,200	10,100	53.2
1980	72,000	336,500	11,200	61.5
1981	87,100	413,000	12,450	70.8
1982	105,000	507,000	13,900	81.2
1983	121,600	616,600	15,400	92.8

This is the total of all general-purpose computers, minis, small business computers (SBCs), and "other" systems such as IBM's S/7. Minis used in SBCs are subtracted to eliminate double counting. Detailed tables follow. (General-purpose and SBC tables are mutually exclusive, but the minicomputer table includes computers subsequently shipped to users -- by the minimakers or by systems houses -- as small business computers.)

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GENERAL-PURPOSE COMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	16,000	111,300	$10,700	$ 54.2
1975	13,800	115,400	10,610	61.3
1976	14,800	112,500	10,830	68.6
1977	17,800	112,800	12,500	77.8
1978	10,600	113,200	14,300	88.9
1979	12,400	118,400	16,600	100.5
1980	20,000	125,200	17,800	112.6
1981	20,500	130,800	18,800	125.0
1982	18,500	136,100	19,800	137.8
1983	16,500	141,400	20,800	151.1
		UNITED STATES		
1974	8,600	61,500	$ 6,200	$ 30.2
1975	6,700	62,100	5,610	33.8
1976	7,200	59,600	5,530	37.9
1977	8,900	58,200	6,600	42.9
1978	4,600	58,000	7,400	48.7
1979	5,800	59,800	8,600	54.7
1980	10,000	62,300	9,200	60.9
1981	10,000	64,300	9,700	67.2
1982	9,000	66,200	10,200	73.7
1983	8,000	68,000	10,700	80.4
		INTERNATIONAL		
1974	7,400	49,800	$ 4,500	$ 24.0
1975	7,100	53,300	5,000	27.5
1976	7,600	52,900	5,300	30.7
1977	8,900	54,600	5,900	34.9
1978	6,000	55,200	6,900	40.2
1979	6,600	58,600	8,000	45.8
1980	10,000	62,900	8,600	51.7
1981	10,500	66,500	9,100	57.8
1982	9,500	69,900	9,600	64.1
1983	8,500	73,400	10,100	70.7

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SMALL BUSINESS COMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	4,150	6,200	$ 200	$ .3
1975	10,600	16,800	400	.7
1976	22,400	39,200	880	1.6
1977	32,500	71,700	1,280	2.9
1978	40,100	110,300	1,725	4.5
1979	49,000	156,200	2,090	6.5
1980	58,700	210,600	2,440	8.8
1981	72,400	277,000	2,870	11.4
1982	88,000	357,800	3,340	14.4
1983	104,900	454,200	3,850	17.9
		UNITED STATES		
1974	3,000	4,500	$ 150	$ .2
1975	7,900	12,400	300	.5
1976	14,800	27,200	580	1.1
1977	21,600	48,800	840	2.0
1978	25,500	72,800	1,105	3.0
1979	30,300	100,900	1,300	4.2
1980	35,700	133,800	1,500	5.6
1981	43,500	173,400	1,740	7.2
1982	52,200	220,900	1,980	8.9
1983	61,600	277,000	2,250	11.0
		INTERNATIONAL		
1974	1,150	1,700	$ 50	$ .1
1975	2,700	4,400	100	.2
1976	7,600	12,000	300	.5
1977	10,900	22,900	440	.9
1978	14,600	37,500	620	1.5
1979	18,700	55,300	790	2.3
1980	23,000	76,800	940	3.2
1981	28,900	103,600	1,130	4.2
1982	35,800	136,900	1,360	5.5
1983	43,300	177,200	1,600	6.9

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MINICOMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	46,600	135,300	$ 940	$ 2.7
1975	48,600	181,400	1,185	3.8
1976	58,400	235,300	1,600	5.2
1977	82,000	311,200	2,315	7.4
1978	100,000	402,300	3,065	10.2
1979	115,000	504,700	3,865	13.7
1980	135,000	621,500	4,845	18.2
1981	165,000	761,700	6,355	24.0
1982	200,000	932,600	8,240	31.6
1983	235,000	1,132,600	10,300	41.0
		UNITED STATES		
1974	33,900	96,100	$ 630	$ 1.9
1975	34,500	126,300	735	2.5
1976	42,000	162,300	1,025	3.4
1977	60,000	214,500	1,550	4.8
1978	71,000	275,300	1,990	6.5
1979	80,500	342,100	2,475	8.7
1980	93,200	417,400	3,055	11.4
1981	113,800	508,000	4,005	14.9
1982	136,000	617,500	5,110	19.5
1983	160,000	746,800	6,400	25.2
		INTERNATIONAL		
1974	12,700	39,200	$ 310	$ .8
1975	14,100	55,100	450	1.3
1976	16,400	73,000	575	1.8
1977	22,000	96,700	765	2.6
1978	29,000	127,000	1,075	3.7
1979	34,500	162,600	1,390	5.0
1980	41,800	204,100	1,790	6.8
1981	51,200	253,700	2,350	9.1
1982	64,000	315,100	3,130	12.1
1983	75,000	385,800	3,900	15.8

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Most systems software comes from the CPU manufacturer, but the independent portion is slated for a 16% compound growth rate during the next five years. The fastest growing subsegment will be communications software, which should grow 19% a year and reach the $50 million level by 1983. The area of system resource management comprises the largest submarket, pegged at $55 million in 1978. Although the IBM 4300 announcement will not affect much of the software industry this year, the early 1980s could see new growth in traditional mainframe sectors such as operating systems and compilers/assemblers.

The utility software market should more than triple by 1983. It is highly fragmented and relatively easy to enter as the development cost seems to be lower than for other areas. There is limited competition from hardware suppliers and the users view this type of software as a help to them rather than as a threat to their jobs. Data management software should account for half of the utility software sector's revenues by 1983, growing from $95 million in 1977 to $440 million in 1983.

The applications market, paced by such standbys as payroll and personnel packages, should have revenues over $1 billion by 1982. Other strong areas are: manufacturing, general accounting, banking/finance and insurance. Other emerging areas include office automation and health care.

TIDBITS FROM NCC

Word has it that IBM has asked AT&T to testify in the U.S. vs. IBM antitrust trial. The thesis would be that regulation has hindered AT&T and therefore enabled IBM to get a larger share of the market than it might have with an unregulated AT&T around.

It's really no surprise that IBM's marketeers still rule the roost. Or, relax, you 1,500 IMS users who are worried that System R may obsolete your IMS investment. You'll have your DL/1 handle onto IMS as a security blanket till the cows come home. But there could well be future enhancements above and below the IMS that could give it more functionality similar to System R features, according to a developer of System R.

And for those fans of IBM's experimental relational data base (System R), look at the 38. Although there was no collaboration between the GSD group and the San Jose researchers who developed R, the 38 does indeed look very much like System R, according to one of R's developers.

IBM's President John Opel, keynote speaker at NCC, foresees that logic gates, etc., will be 100 times what they are today at 1/20th the cost by the late 1980s.

Teletype Corp.'s executive vice-president, Roger Moody, a former Bell executive, has his own ideas on how Ma Bell should reorganize. The current geographical lines no longer make sense, he observed. Rather, the company should be geared to serve the customer both on premises and via long lines etc. Long Lines probably will be the means to develop this force, but whether it will still be Long Lines depends -- the charge might go to Bolger or McGill, he speculated.

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GENERAL-PURPOSE COMPUTER CENSUS

Counts in the General-Purpose Computer Census are based on the best information available to IDC -- but are estimates nevertheless. Computer makers, as a rule, do not directly supply this type of data. General-purpose computers -- as characterized by IBM's 370, 303X and competitors -- comprise the bulk of digital computers by value. They are primarily character or byte oriented and programmed in higher-level language.

Instead of being pegged to constantly shifting average values, size classes are based on currently marketed IBM products and other manufacturers' models that compete with them, e.g., a computer in Size Class 7 would compete with an IBM 3033 or 168. (Other classes can be checked under IBM's column.) Note that many mainframe manufacturers also offer smaller systems that are included in the Small Business Computer Census. An "x" in the last column means none on order from the original manufacturer.

AS OF JANUARY 1, 1979

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
Amdahl	470V/5	6	$ 60,000	9/77	28	8	36	35
	470V/6	7	$ 83,000	6/75	113	41	154	85
	470V/7	7	$ 89,000	8/78	9	4	13	30
	470V/8	7	$ 90,000	9/79	-	-	-	10
	Total				150	53	203	160
Burroughs	B2/3/500	3	$ 6,600	11/61	365	245	610	X
	B1710	2	$ 2,700	8/72	1,110	620	1,730	X
	B1720	3	$ 6,900	2/73	560	280	840	X
	B1820/30	2	$ 3,000	5/77	70	80	150	175
	B1860/70	3	$ 6,500	5/77	225	125	350	425
	B2500	4	$ 10,400	2/67	40	60	100	X
	B2700	4	$ 10,700	8/72	375	200	575	X
	B2800	4	$ 11,900	12/76	95	26	121	90
	B3500	4	$ 19,000	5/67	285	245	530	X
	B3700	4	$ 25,000	11/72	335	275	610	X
	B3800	4	$ 17,800	4/77	75	30	105	120
	B45/4700	5	$ 32,000	10/71	340	135	475	X
	B4800	5	$ 36,000	9/76	80	55	135	90
	B5500	5	$ 35,000	3/63	37	14	51	X
	B5700	5	$ 33,500	12/70	4	6	10	X
	B65/6700	6	$ 66,000	11/69	160	110	270	X
	B6800	5	$ 47,500	6/77	65	50	115	100
	B7700	7	$142,000	8/73	37	21	58	5
	B7800	7	$150,000	11/78	2	1	3	20
	Total				4,260	2,578	6,838	1,025
CDC	Omega 480-1	4	$ 10,700	6/77	48	-	48	60
	Omega 480-2	5	$ 14,200	8/78	2	-	2	5
	Cyber-71	4	$ 20,000	7/76	4	9	13	5
	Cyber-171	4	$ 27,000	8/77	9	29	38	35
	Cyber-72	5	$ 41,000	10/71	14	48	62	X
	Cyber-172	6	$ 48,000	7/75	28	42	70	15
	Cyber-73	6	$ 62,000	3/72	21	36	57	X
	Cyber-173	6	$ 79,000	9/75	10	38	48	5
	Cyber-74	7	$141,000	3/72	29	16	45	X
	Cyber-174	6	$ 97,000	9/75	10	14	24	2
	Cyber-175	7	$147,000	8/75	20	30	50	30
	Cyber-76	7	$184,000	3/72	7	10	17	X
	Cyber-176	7	$184,000	1/78	6	2	8	10
	C-20	4	$ 19,300	4/61	3	-	3	X
	1604	6	$ 41,000	1/60	8	-	8	X
	31/3150	4	$ 9,700	12/64	48	19	67	X
	3170	5	$ 22,500	12/70	19	17	36	X
	3200	4	$ 14,700	5/64	31	20	51	X
	3300	5	$ 34,500	9/65	86	50	136	X
	3400	5	$ 23,500	11/64	3	3	6	X
	3500	5	$ 31,000	1/69	30	10	40	X
	3600	6	$ 49,000	6/63	16	13	29	X
	3800	6	$ 60,000	12/65	12	2	14	X
	6200	6	$ 44,000	11/70	-	3	3	X
	6400	6	$ 63,000	5/66	47	33	80	X
	6500	6	$ 86,000	12/67	15	12	27	X
	6600	7	$116,000	8/64	49	21	70	X
	6700	7	$140,000	7/70	3	-	3	X
	7600	7	$195,000	1/69	23	6	29	X
	Star-100	7	$280,000	12/74	4	-	4	X
	Cyber-203	7	$210,000	/79	-	-	-	5
	Total				605	483	1,088	172
Cray	Cray 1A	7	$196,000	4/76	6	2	8	8
DEC	2020	3	$ 6,900	7/78	60	5	65	125
	2040	4	$ 10,900	6/76	85	65	150	25
	2050	4	$ 19,500	5/77	70	30	100	70
	2060	5	$ 22,500	2/79	-	-	-	20
	PDP-6	4	$ 10,000	10/64	6	1	7	X
	1040/50	4	$ 17,300	10/67	140	110	250	X
	1060/70	5	$ 21,000	6/72	140	100	240	30
	1080/90	6	$ 30,500	6/75	133	65	200	60
	Total				636	376	1,012	330
Honeywell	H-61/40	2	$ 2,100	6/76	-	470	470	]
	H-61/58	2	$ 2,300	6/74	120	660	780	] 250
	H-61/60	2	$ 3,300	6/74	75	1,040	1,115	]
	H-Level 62	3	$ 5,200	10/74	630	880	1,510	400
	H-Level 64	4	$ 11,200	10/74	270	610	880	220
	H-66/05/07	4	$ 18,100	10/76	73	120	193	100
	H-66/10/17	5	$ 29,000	6/75	69	100	169	30
	H-66/20/27	5	$ 40,000	11/74	90	120	210	15
	H-66/40/60	6	$ 80,000	10/74	87	83	170	30
	H-66/DPS	6	$ 71,000	7/78	2	1	3	35
	H-66/80	7	$120,000	10/74	15	16	31	10
	H-68/80	7	$102,000	10/74	15	2	17	X
	H-68/DPS	7	$121,000	9/78	1	1	2	10
	S-60 Subtotal				1,447	4,103	5,550	1,100
	G-50	2	$ 1,900	8/70	195	1,150	1,345	X
	G-100	3	$ 4,900	4/66	85	975	1,060	X
	G-200	4	$ 10,000	4/61	110	18	128	X
	G-400	4	$ 15,900	5/64	195	160	355	X
	G-600	6	$ 77,000	4/65	35	21	56	X
	G-6023/25	5	$ 33,000	11/73	31	26	57	X
	G-6030/40	5	$ 43,000	6/71	53	120	173	X
	G-6050/60	6	$ 73,000	7/71	88	64	152	X
	G-6070/80	6	$111,000	7/71	55	32	87	X
	G-6180	7	$108,000	2/74	5	-	5	X
	Gamma 10	2	$ 2,500	7/64	-	590	590	X
	Gamma 30	4	$ 10,000	2/62	-	43	43	X
	G-Subtotal				852	3,199	4,051	X
	H-105/115	3	$ 6,400	3/70	210	240	450	X
	H-110/120/200	3	$ 6,600	1/66	340	230	570	X
	H-123	4	$ 8,600	12/67	18	120	138	X
	H-2020/30	3	$ 4,400	1/73	505	175	680	X
	H-1015/2015	4	$ 18,500	2/71	55	40	95	X
	H-1200	4	$ 14,600	2/66	200	76	276	X
	H-2040	4	$ 13,700	4/72	210	120	330	X
	H-2050/2060	4	$ 21,000	4/72	145	112	257	X
	H-2200	4	$ 20,000	1/66	89	27	116	X
	H-2070	5	$ 36,000	5/72	31	2	33	X
	H-3200	5	$ 28,500	2/70	85	36	121	X
	H-4200	5	$ 46,500	9/68	10	3	13	X
	H-8200	6	$ 71,000	2/69	14	10	24	X
	H-4/1400	4	$ 13,500	12/61	12	14	26	X
	H-8/1800	5	$ 35,000	12/60	10	12	22	X
	H-Subtotal				1,934	1,217	3,151	X
	Total				4,233	8,319	12,752	1,100

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AS OF JANUARY 1, 1979

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
IBM	System/38-3	2	$ 3,600	8/79	-	-	-	5,000
	System/38-5	3	$ 9,700	2/80	-	-	-	3,000
	System/3-4	2	$ 1,300	6/76	580	160	740	X
	System/3-6	2	$ 1,800	12/70	740	700	1,440	X
	System/3-8	2	$ 2,100	6/75	4,850	4,250	9,100	X
	System/3-10	2	$ 2,700	1/70	6,900	4,700	11,600	X
	System/3-12	3	$ 3,800	3/76	4,550	2,980	7,530	X
	System/3-15	3	$ 6,800	3/74	3,130	2,000	5,130	200
	S/3 Subtotal				20,750	14,790	35,540	8,200
	4331	3	$ 7,600	6/79	-	-	-	2,000
	4341	4	$ 18,900	11/79	-	-	-	2,000
	3031	6	$ 61,000	3/78	230	210	440	1,200
	3032	6	$114,000	3/78	100	90	190	350
	3033	7	$180,000	3/78	220	120	340	450
	370/115	3	$ 9,300	4/74	1,040	2,370	3,410	X
	370/125	4	$ 13,000	6/73	980	1,800	2,780	X
	370/135	4	$ 20,500	5/72	1,290	1,820	3,110	X
	370/138	4	$ 21,000	11/76	1,910	2,700	4,610	200
	370/145	5	$ 39,000	7/71	1,210	1,370	2,580	X
	370/148	5	$ 34,500	3/77	1,600	1,970	3,570	50
	370/155	6	$ 72,000	2/71	440	290	730	X
	370/158	6	$104,000	5/73	1,550	1,430	2,980	X
	370/165	7	$133,000	6/71	115	42	157	X
	370/168	7	$194,000	7/73	650	310	960	X
	370/195	7	$275,000	3/71	13	4	17	X
	370 Subtotal				11,348	14,526	25,874	6,250
	360/20	3	$ 2,900	12/65	900	1,680	2,580	X
	360/22	3	$ 3,700	7/71	76	90	166	X
	360/25	3	$ 8,300	10/68	76	340	416	X
	360/30	4	$ 11,200	6/65	1,560	800	2,360	X
	360/44	4	$ 18,700	7/66	42	37	79	X
	360/40	4	$ 19,000	6/65	1,050	740	1,790	X
	360/50	5	$ 33,500	8/65	495	240	735	X
	360/65	6	$ 70,000	11/65	390	135	525	X
	360/67	7	$140,000	6/66	16	7	23	X
	360/75	7	$122,000	1/66	25	11	36	X
	360/85	7	$183,000	10/69	1	1	2	X
	360/9X	7	$197,000	11/67	10	5	15	X
	360 Subtotal				4,641	4,086	8,727	X
	1130	2	$ 2,600	2/66	1,240	1,100	2,340	X
	1401	3	$ 3,700	9/60	500	415	915	X
	1401-G	2	$ 2,400	5/64	10	5	15	X
	1401-H	2	$ 1,750	6/67	5	-	5	X
	1410	4	$ 17,100	11/61	24	19	43	X
	1440	3	$ 4,700	4/63	56	78	134	X
	1460	4	$ 9,600	10/63	14	9	23	X
	1620	3	$ 2,700	9/60	94	82	176	X
	7010	5	$ 25,500	10/63	6	3	9	X
	7030	7	$160,000	5/61	1	-	1	X
	7040/44	5	$ 30,000	6/63	9	13	22	X
	7070/74	5	$ 27,000	3/60	62	9	71	X
	7080	6	$ 60,000	8/61	23	-	23	X
	7090/94	6	$ 71,000	8/60	25	8	33	X
	Subtotal				2,069	1,741	3,810	X
	Total				38,808	35,143	73,951	14,450
Itel	AS/3	4	$ 13,700	11/78	8	2	10	75
	AS/4	5	$ 23,000	6/77	70	20	90	100
	AS/5	6	$ 37,500	3/77	120	45	165	150
	AS/6	6	$ 57,500	5/78	30	10	40	60
	Total				228	77	305	385
Magnuson	M80/3	4	$ 6,200	/79	-	-	-	25
	M80/4	5	$ 10,000	12/78	6	-	6	50
	Total				6	-	6	75
NCR	8270	2	$ 1,700	11/79	-	-	-	100
	8350	2	$ 3,200	6/77	110	-	110	125
	8370	3	$ 5,500	7/78	10	-	10	50
	8410	2	$ 3,000	2/79	-	-	-	50
	8430	3	$ 4,800	6/78	10	-	10	30
	8450	3	$ 6,800	11/77	175	65	240	200
	8550	3	$ 11,700	4/76	310	235	545	80
	8560	4	$ 13,600	11/77	40	10	50	40
	8570	4	$ 17,400	5/76	65	75	140	60
	8580	5	$ 35,000	12/78	3	-	3	45
	8590	6	$ 50,000	9/79	-	-	-	5
	Century-50	2	$ 1,700	2/71	390	50	440	X
	Century-75	2	$ 2,200	7/76	75	-	75	X
	Century-100	3	$ 3,300	9/68	300	630	930	X
	Century-101	3	$ 4,100	10/72	860	670	1,530	X
	Century-151	3	$ 5,400	2/75	270	145	415	X
	Century-200	4	$ 7,600	9/69	200	335	535	X
	Century-201	4	$ 11,600	8/74	255	150	405	X
	Century-251	4	$ 20,500	11/73	60	72	132	X
	Century-300	5	$ 26,500	2/72	85	85	170	X
	315	3	$ 3,400	5/62	73	100	173	X
	315-RMC	4	$ 10,400	9/65	18	16	34	X
	Total				3,309	2,638	5,947	785
Singer	System 10	2	$ 2,700	10/70	1,400	1,200	2,600	X
Sperry-Univac	III	4	$ 27,000	8/62	80	28	108	X
	SS-80/90	3	$ 8,500	8/58	-	4	4	X
	418 I, II	4	$ 10,700	6/63	44	51	95	X
	418 III	4	$ 40,500	6/69	44	88	132	X
	491/492	5	$ 28,000	12/61	13	8	21	X
	494	6	$ 81,000	2/66	61	58	119	X
	1004	2	$ 1,100	2/63	240	200	440	X
	1005	2	$ 2,000	4/66	200	80	280	X
	1050	3	$ 9,000	9/63	120	36	156	X
	1106	6	$ 45,500	12/69	75	190	265	X
	1107	6	$ 60,000	10/62	4	8	12	X
	1108	7	$ 92,000	9/65	152	85	237	X
	1110	7	$145,000	6/72	58	73	131	X
	9200	2	$ 2,300	6/67	525	560	1,085	X
	9300	3	$ 5,000	9/67	410	410	820	X
	9400/80	4	$ 12,600	5/69	230	420	650	X
	90/25	3	$ 4,200	8/77	55	95	150	50
	90/30	3	$ 8,200	2/75	755	1,100	1,855	300
	90/40	4	$ 15,500	6/78	5	10	15	75
	90/60	4	$ 24,000	1/74	110	130	240	40
	90/70/9700	5	$ 29,000	8/72	17	40	57	5
	90/80	5	$ 64,000	12/76	30	15	45	25
	1100/10	5	$ 40,500	4/76	60	135	195	100
	1100/20	5	$ 55,000	4/75	16	38	54	5
	1100/40	6	$ 95,000	7/75	36	46	82	5
	1100/81/82	6	$112,000	3/77	36	37	73	60
	1100/83	7	$195,000	12/78	1	1	2	10
	1100/84	7	$238,000	11/78	1	-	1	5
	Subtotal				3,378	3,946	7,324	680
	301	4	$ 6,700	10/60	26	4	30	X
	501	5	$ 15,800	6/59	2	-	2	X
	3301	5	$ 23,500	7/64	41	-	41	X
	Spectra 70/15	3	$ 4,600	9/65	3	-	3	X
	Spectra 70/25	3	$ 7,800	9/65	-	7	7	X
	Spectra 70/35	4	$ 14,400	1/67	53	3	56	X
	Spectra 70/45	5	$ 27,000	11/65	150	6	156	X
	Spectra 70/46	5	$ 44,500	11/68	23	1	24	X
	Spectra 70/55	5	$ 41,500	11/68	5	-	5	X
	Spectra 70/60	6	$ 51,000	9/70	25	-	25	X
	Spectra 70/61	6	$ 55,000	3/71	4	-	4	X
	Spectra 1600	3	$ 4,300	1/69	35	-	35	X
	Spectra 70/2	4	$ 14,100	7/71	34	-	34	X
	Spectra 70/3	4	$ 23,500	10/71	15	-	15	X
	Spectra 70/6	6	$ 39,000	10/71	34	-	34	X
	Spectra 70/7	6	$ 48,000	10/71	18	-	18	X
	Subtotal				468	21	489	X
	Total				3,846	3,967	7,813	680
Xerox	Sigma 5	4	$ 14,600	8/67	121	21	142	X
	Sigma 6	4	$ 25,000	11/70	32	13	45	X
	Sigma 7	5	$ 29,000	12/66	58	9	67	X
	Sigma 8	4	$ 22,500	9/71	5	6	11	X
	Sigma 9	6	$ 57,000	11/71	76	30	106	X
	530	3	$ 4,200	8/73	101	37	138	X
	550/560	4	$ 14,500	11/74	29	5	34	X
	940	5	$ 26,000	4/66	36	3	39	X
	9300	3	$ 8,500	11/64	15	4	19	X
	Total				473	128	601	X
TOTAL					57,960	55,164	113,124	19,170

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SMALL BUSINESS COMPUTER CENSUS

The categorization of certain computers as "small business computers" is based on marketplace definitions as perceived by IDC. SBCs are those small general-purpose computers marketed by the major mainframers and their competitors to smaller businesses and first-time users. They include offerings from the major mainframers (such as IBM's System/32); products such as DEC's Datasystem/300 from the minimakers but aimed at commercial first-time users; equipment from firms (such as Qantel) that manufacture only SBCs; and products from companies that assemble systems from other's minicomputers as Basic/Four did before beginning its own manufacturing operations.

AS OF JANUARY 1, 1979

NAME OF MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	NOTES	PURCHASE PRICE ($1,000) BASIC	PURCHASE PRICE ($1,000) AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1979 INSTALLATION
Advanced Information Design	System 3000	Interdata X/16		24	39	3/75	41	0	41	NA
	System 4000	Interdata X/32		49		/78	NA	NA	NA	NA
Anderson-Jacobson, Inc.	1400	AJ 1400	a	16	22	1/70	260	15	275	X
	1520 Series	AJ 1500		19	21	7/77	140	20	160	45
	1560 Series	AJ 1500		30	35	7/77	40	0	40	45
Applied Data Communications	Event	Event		13	20	2/77	90	10	100	350
Applied Data Processing, Inc.	Resource 50	Nova-3/4		31	52	9/79	0	0	0	4
	Resource 100	Nova-3/12		41	72	6/76	14	0	14	6
Automated Business Concepts	Mesa Two	Nova-3		60	65	4/78	19	0	19	25
Ball Computer Products*	DASL	Nova-2/10		38	40	6/75	3	0	3	X
Basic/Four Corp.	200	BFC 1340		25	29	2/78	150	50	200	250
	350	BFC 1300, Microdata	b	34	34	9/71	500	576	1,076	X
	400	BFC 1300, Microdata	b	37	45	9/71	1,900	1,551	3,451	X
	410	BFC 1300		33	40	10/78	150	70	220	1,000
	500	BFC 1300, Microdata	b	39	50	7/72	100	82	182	X
	600	BFC 1300, Microdata	b	51	65	3/75	300	308	608	X
	610	BFC 1320		51	65	1/78	235	200	435	500
	700	BFC 1320		115	130	/77	115	93	208	X
	730	BFC 1350		110	125	6/78	65	55	120	260
	Total						3,515	2,985	6,500	
Binary Data Systems	UCOM-1	Nova-3, 4		40	60	11/75	48	0	48	X
	UCOM-2	Dual Nova-3		95	120	1/76	20	0	20	X
	UCOM-3	Eclipse S/130		120	170	6/76	6	0	6	15
	UCOM-4	Dual Eclipse S/130		200	285	5/77	20	0	20	20
BRD, Inc.	Dolphin			18	20	6/77	500	25	525	NA
	Porpoise			10	13	1/78				NA
BTI Computer Systems	4000/15	BTI 4020		35	40	1/76	341	8	349	X
	4000/25	BTI 4020		56	65	1/76	251	12	263	X
	5000	BTI 5030		39	44	9/78	190	2	192	1,100
Burroughs	B80	B80		20	35	11/76	2,000	2,500	4,500	2,500
	B700	B700		20	68	3/73	2,550	1,850	4,400	X
	B800	B800		32	53	5/77	1,000	700	1,700	2,000
	Total						5,550	5,050	10,600	
Business Controls Corp.	System 80	PDP-8/a		25	40	6/71	110	0	110	20
	System 80	PDP-11/23/34/60/70/VAX		40	80	6/75	70	5	75	45
Business Systems Products	Adviser	C. A. Syfa		42	50	7/76	100	0	100	200
Cado	Cado System 20	Intel 8080		14	16	4/76	730	270	1,000	
	Cado System 40	Intel 8080		18	20	4/76				1,100
	Cado System 20/4	Intel 8085		16	36	6/78	70	30	100	
	Cado System 40/4	Intel 8085		20	45	6/78				
Cascade Data, Inc.	80/20, 30, 40	Concept		28	43	1/70	50	0	50	X
	Concept II	Concept		27	35	6/75				
	Concept III	Concept		32	39	1/78	270	15	285	50
	Concept IV	Concept		17	19	4/78				
Century Computer Corp.	C-400	C-200, 400		34	45	3/75	185	35	220	NA
	C-700	C-200, 400		38	55	6/76	50	10	60	NA
	C-900	C-400		27	40	4/77	115	25	140	NA
	C-1000	C-400		40	50	6/77	20	0	20	NA
	Opus III	C-200		15	22	2/71	550	40	600	X
	Total						930	110	1,040	
Cincinnati Milacron	George 40	CIP/2200 B		16	20	2/77				NA
	George 60	CIP/2200 B		26	34	/76				NA
	George 70	CIP/2200 B		26	35	/76	630	150	780	NA
	George 80	CIP/4400		43	60	12/76				NA
	Other	CIP/2200 B		23	34	/74				NA
Clary Data Systems*	404	Clary		6	30	1/70	100	32	132	X
Complete Computer Systems	10, 11, 12	Nova-3/12		31	43	3/74	30	0	30	
	14, 16, 18	Nova-3/12		45	58	10/76	20	0	20	22
	20, 22, 24	Nova-3/12		58	74	9/77	12	0	12	
Compucorp	402	Compucorp 3000		13	15	1/76	15	455	470	X
	450	Compucorp 3000		20	22	4/76	40	115	155	X
Compudata	Series/1	IBM Series/1		26	33	10/77	30	10	40	50
Computer Hardware, Inc.	2120	CHI		15	50	5/75	10	0	10	X
	2130 C	CHI C		32	75	7/74	200	5	205	20
	2130 D	CHI D		44	120	1/78	3	0	3	5
	3230	CHI		15	50	6/76	25	0	25	25
	4210	CHI		13	13	9/77	4	0	4	5
	4250	CHI		37	45	6/78	7	0	7	10
	Total						249	5	254	
Computer Horizons Corp.*	CHI Distribution System	PDP-11/34, 70		30	200	10/76	9	0	9	X
Computer Interactions, Inc.	Compo II-8	PDP-8/e, f, m		40	55	11/72	211	0	211	20
	Compo II-11	PDP-11		40	55	6/75	129	0	129	85
	Word Pro II	PDP-8/a, Nova or H-P		13	19	2/77	145	0	145	200
Computer Systems Development, Inc.	Sentinel	8086		10		/79	0	0	0	100
Data General	CS/20	MicroNova		11	20	7/78	50	10	60	150
	CS/40	Nova-3/12		33	40	10/77	300	100	400	400
	CS/60	Eclipse		40	75	7/78	10	0	10	50
	Design Data EC300	Eclipse C/300	c	60	150	3/76	50	10	60	X
	Design Data N312	Nova-3/12	c	31	75	8/75	120	10	130	X
(Digital Computer Controls)	Synergist 1500	MicroNova	d	8	24	/76	15	0	15	30
	Synergist 1550	MicroNova	d	14	21	7/78	10	0	10	30
	Synergist 2500	Nova-3/12	d	27	40	/76	100	0	100	100
	Synergist 3700	Nova-3/D	d	40	60	/76	15	0	15	NA
	Total						670	130	800	
Decision Data Computer Corp.*	System/4	System/4		23	37	8/76	15	0	15	X
Diablo Systems, Inc.	3200	8080	e	19	23	1/77	400	250	650	NA
Digital Equipment Corp.	Datasystem 300	PDP-8, PDP-11		14	30	/72	5,300	2,200	7,500	2,500
	Datasystem 500	PDP-11		58	115	/72	900	700	1,600	600
Digital Systems Corp.	Galaxy/5	Galaxy/5		90	120	1/76	24	0	24	10
Dimis, Inc.	Total 100	Modcomp II		120	120	7/74	14	0	14	NA
	Total 100	Classic		205	205	1/79	5	0	5	NA
Display Data Corp.	Insight	Microdata 1600/30		38	59	1/74	440	10	450	500
	ELS System	Microdata 1600/30		27	33	5/78				125
DTC	YakMaster	Intel 8080		17	19	9/78	15	50	65	500
Financial Computer Corp.	System III/8	System III		19	25	9/77	28	0	28	NA
	System III/8	System III		23	32	9/77	22	0	22	NA
	System III/10	System III		30	45	1/75	440	55	495	NA
Gemini Information Systems	Gispac/1	Series/1		48	66	4/78	15	0	15	15
	Gispac/16	Interdata X/16		48	65	4/76	34	0	34	10
	Gispac/32	Interdata X/32		86	110	4/76	17	0	17	10
General Automation, Inc.	DM-130/2	SPC-16/45		28	28	12/74	150	250	400	20
	DM-130	SPC-16/45		30	38	12/74	80	130	210	50
	DM-140	SPC-16/65		48	80	1/75	10	18	28	X
	440-DS	GA-16/440		38	70	1/76	25	60	85	100
	460-DS	GA-16/460		35	80	11/78	NA	NA	NA	NA
	Total						265	458	723	

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NAME OF MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	NOTES	PURCHASE PRICE ($1,000) BASIC	PURCHASE PRICE ($1,000) AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1979 INSTALLATION
General Information Systems	GIS-350 ABLE	PDP-11/34		36	40	1/76	12	0	12	8
General Robotics Corp.	FD/X3	LSI-11		11	22	7/76	120	130	250	NA
	CD/X3	LSI-11		18	32	9/77	40	40	80	NA
GRI Computer Corp.	System 99	GRI 99/50		30	35	11/74	189	85	274	10
	System 99/E	GRI 99/52		43	50	11/77	7	3	10	40
Hewlett-Packard	HP 250	HP 250		24		/79	0	0	0	200
IBM	System/32	IBM S/32	f	33	42	3/75	13,300	6,000	19,300	X
	System/34	IBM S/34		35	50	12/77	9,000	3,500	12,500	16,000
	Total						22,300	9,500	31,800	
Infotecs	Imp	IM 6100		10	14	9/77	270	10	280	750
International Computing Co.*	System 95/99	Nova-2/10		24	35	10/72	9	0	9	X
Jacquard	J-100	NS IMP-16		12	41	8/75	250	150	400	NA
Keydata	Unity Series	Nova 3/4, 3/12, 3/D		48	80	4/79	0	0	0	55
Lockheed Electronics Co., Inc.	System III	Lockheed SUE		30	50	1/73	440	60	500	NA
Logical Machine Corp.	ADAM	ADAM		30	35	4/75	320	360	680	350
	TINA	TINA		18	20	12/78	21	19	40	550
Martin Wolfe, Inc*	Mesa Two 7000	DCC-116		54	81	12/71	140	0	140	X
	Mesa Two 4000	DCC-116		62	93	2/76	3	0	3	X
Microdata	Reality	Microdata 1600		32	60	12/73	2,000	400	2,400	NA
Microstar, Inc.	Microstar I	Zilog Z-80		13	17	12/78	5	0	5	150
	Microstar II	Zilog Z-80		14	19	12/78				
Mini-Computer Systems, Inc.	Micos 100	Nova-3/4		34	40	8/77	20	60	80	50
	Micos 200	Nova-3/12		40	60	/73	765	285	1,050	400
	Micos 300	Dual Nova-3/12		100	140	1/79	0	0	0	25
Minutemen Computer Corp.	1774	Nova-3/4		30	40	11/71	38	0	38	
	1775	Nova-3/12		32	44	3/72	18	0	18	40
	1776	Nova-3/12		35	59	3/72	26	0	26	
	1776/A	Nova-3/12		35	65	5/77	20	0	20	
Mylee Digital Sciences, Inc.	3000 Series	Mylee 3G		29	60	5/76	110	0	110	30
NCR Corp.	8130	NCR		20	24	3/78	275	325	600	800
	8150	NCR		29	38	12/77				
	8200	NCR		33	66	9/75				
	8230	NCR		29	53	6/77	2,200	3,000	5,200	2,500
	8250	NCR		42	60	12/76				
	Total						2,475	3,325	5,800	
Norfield Datasystems, Inc.*	Nova-System	Nova		35	50	6/73	20	0	20	X
Northrup Data Systems	BDS 500/700	Microdata 1600		30	50	3/77	30	0	30	
	BDS 1000	Microdata 1600		51	55	6/72	65	0	65	150
	BDS 2000	Microdata 1600		52	74	10/73	75	0	75	
	BDS 3000	Microdata 1600		125	135	4/79	0	0	0	
Pick & Associates	Evolution System	7764		65	77	11/73	104	12	116	115
	Evolution System	7787		88	97	10/77	18	2	20	35
Programmed Control Corp.	Prophet 21/1	TI 960-B		42	75	/72	35	0	35	NA
	Prophet 21/2	TI 990/10		57	100	1/78	11	1	12	NA
Q1 Corp.	Q1/LMC	8080		21	23	2/74	550	0	550	NA
	Q1/LITE	8800		21	26	2/77	350	250	600	NA
	Q1/MICROLITE	8800		12	17	1/79	0	0	0	500
Qantel	210	Q29		12	17	11/77	175	175	350	600
	800/900	Q7		28	29	5/75	93	71	164	X
	950	Q7		28	33	11/75	497	179	676	150
	960	Q7.5		30	35	11/76	58	34	92	150
	970	Q29B		36	40	1/79	0	0	0	250
	1200	Q7		42	59	11/75	213	23	236	X
	1300	Q7.5		42	59	11/75	44	18	62	X
	1400, -2	Q7.5		44	70	5/77	314	141	455	100
	1450, -2	Q29B		45	80	1/79	0	0	0	350
	Total						1,394	641	2,035	
Quodata Corp. (Educomp)	E-250, 500	PDP-8		15	30	/72				NA
	E-660,760,820,960	PDP-11		44	100	/75	237	21	258	NA
	QDP/78	PDP-8		10	10	/77				NA
	ECS/7800	PDP-8		10	11	/77				NA
Randal Data Systems	R-100 Series	Randal		14	17	10/75	245	10	255	125
	R-200 Series	Randal		24	30	10/76	352	0	352	240
	R-300 Series	Nova-2/10		34	45	6/74	27	0	27	X
	R-400 Series	Nova-2/10		36	45	6/74				X
	R-500 Series	Randal		42	47	10/77	40	0	40	35
	Total						664	10	674	
A. O. Smith*	Mesa Two	Nova-3		58	58	5/77	10	0	10	X
Span Management Systems*	TSS-2	IBM Series/1		31	31	/77	10	3	13	X
Sperry-Univac	BC-7	Univac		22	43	4/77	700	50	750	700
STC Systems, Inc.	Ultimacc-2000	Nova-3/12		34	80	9/72	98	2	100	10
	Ultimacc-3010	Nova-3/D		55	112	1/75	88	2	90	20
	Ultimacc-3080	Nova-3/D		84	143	11/75	15	0	15	10
Tri-Star, Inc.*	TTK-10	Nova-3/12		45	55	2/76	12	0	12	X
	TEK-80	Nova-3/12		52	67	4/76	4	0	4	X
Vanguard Computer Systems, Inc.	V400	Raytheon RDS 500		45	52	6/77	2	0	2	NA
	V500	Raytheon RDS 500		65	85	3/76	7	3	10	NA
Wang Laboratories, Inc.	2200	2200		10	19	4/73	11,260	7,410	18,670	4,000
	2200 VP	2200 VP		15	20	9/76	1,280	860	2,140	1,600
	2200 MVP	2200 MVP		18	27	1/78	360	300	660	1,000
	VS	2200 VS		47	75	10/77	210	110	320	500
	Total						13,110	8,680	21,790	
Warrex Computer Corp.	Centurion I-A	CC-205		18	19	/77	60	0	60	60
	Centurion II-A	CC-205		27	30	/75	95	0	95	70
	Centurion III	CC-205		36	36	/74	400	0	400	230
	Centurion V	CC-205		43	43	/75	85	0	85	70
	Centurion Series 100	CC-205		14	15	/79	0	0	0	30
	Centurion Series 200	CC-205		25	28	/79	0	0	0	40
	Total						640	0	640	
Wintex Computer Corp.	200 NS	Wintex		12	18	1/75	75	1	76	30
	MT 200	Wintex		10	20	/79	0	0	0	20
TOTAL							71,524	37,282	108,806	

Notes:

a) Includes installations of Eldorado 140
b) Used Microdata processors until 11/76
c) Design Data was acquired by Data General in February 1977
d) Digital Computer Controls was acquired by Data General in early 1977
e) Marketed in the U.S. by Shasta General Systems
f) U.S. installation figures account for retirements
*) Not currently active in manufacturing or marketing small business computers
NA) Data is not available
X) Model not in new production

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MINICOMPUTER CENSUS

The categorization of certain computers as "minicomputers" is based on marketplace definitions as perceived by IDC. Minis are general-purpose in design but sold as tools, not just solutions; are available from the makers as complete systems, not just boards; are available to OEMs and usually discounted in volume buys; and are part of a family that has at least one product in the $2,000-$25,000 price range and comes with at least 4K RAM. Size classes are: (S) Supermini; (T) Traditional Mini; (M) Micromini.

AS OF JANUARY 1, 1979

NAME OF MANUFACTURER	COMPUTER MODEL	BITS PER WORD	SIZE	PURCHASE PRICE ($1,000) BASIC	PURCHASE PRICE ($1,000) AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1979 INSTALLATION
Ampex	8 MS 5	16	T	3	4	5/78	NA	NA	NA	NA
	8 C10	16	T	3	5	11/78	NA	NA	NA	NA
Artonix	PC-12/7	12	T	20	45	9/71	135	40	175	X
Bytronix	Series 1000	16	T	5	5	12/77	50	150	200	300
	Series 2000	16	T	8	8	12/78	0	30	30	250
	Series 3000	16	T	7	8	12/78	0	10	10	150
Century Computer Corp.	C-200	8	T	5	7	2/71	150	0	150	X
Cincinnati Milacron	CIP/2000 Series	8	T	4	17	7/69	3,835	725	4,560	NA
	CIP/4000 Series	16	T	4	17	12/76				NA
Compiler Systems, Inc.*	CSI-16	16	T	11	20	11/70	80	10	90	X
	CSI-24	24	T	15	30	12/70	35	5	40	X
Computer Automation, Inc.	108/208/808	8	T	5	11	4/68	280	30	310	X
	116	16	T	8	16	8/70	200	50	250	X
	216	16	T	8	20	7/69	350	45	395	X
	816	16	T	10	15	12/68	40	5	45	X
	Alpha-8, Naked Mini-8	8	T	2	3	5/72	4,256	1,140	5,397	X
	Alpha-16, Naked Mini-16	16	T	3	8	10/71				290
	LSI-2/10, 2/20, 2/60	16	T,T,S	2	5	12/73	15,725	1,664	17,389	4,610
	LSI-3/05	16	M	1	2	2/76	1,345	365	1,710	755
	LSI-4/10	16	M	1	2	6/77	470	107	577	
	LSI-4/30	16	T	2	4	6/77	352	94	446	1,315
	LSI-4/90	16	S	4	9	6/77	186	37	223	
	Total						23,205	3,537	26,742	
Computer Talk, Inc.	CT-400	16	T	25	30	9/75	7	0	7	NA
	CT-407	16	T	32	37	12/77	1	0	1	NA
Control Data Corp.	1700	16+2	S	37	160	3/66				X
	1700-SC	16+2	S	20	60	9/70				X
	System 17	16+2	T	14	39	2/74				
	Cyber-18-10	16+2	T	14	40	/76	1,430	960	2,390	
	Cyber-18-20	16+2	T	16	75	/76				1,000
	Cyber-18-30	16+2	S	110	116	9/76				
	Cyber-18-5	16+2	T	14	35	/77				
	Eibit-100	12	T	6	8	6/67	5	445	450	X
	Total						1,435	1,405	2,840	
Data General Corp.	MP 100, 200	16	M	1		/79	0	0	0	500
	Nova-4/S, C, X	16	T	4		4/79	0	0	0	4,000
	Nova	16	T	6	12	2/69	750	400	1,150	X
	MicroNova	16	M	2	4	11/76	2,370	560	2,930	2,500
	Nova-2 Series	16	T	3	8	10/73	5,550	1,950	7,500	100
	Nova-3/4	16	T	2	4	1/76	2,200	800	3,000	
	Nova-3/12	16	T	12	17	1/76	8,600	2,550	11,150	4,000
	Nova-3/D	16	T	12	35	10/76	1,300	450	1,750	
	Nova-800/820	16	T	7	34	3/71	2,180	720	2,900	20
	Nova-830/840	16	S	16	43	7/73	660	360	1,020	
	Nova-1200 Series	16	T	3	11	12/70	8,400	3,450	11,850	100
	SuperNova, SC	16	T	9	27	4/70	300	150	450	X
	Eclipse-S/100, 130	16	S	11	30	2/75	2,270	810	3,080	2,500
	Eclipse-AP/130	16	S	30	50	9/78	10	0	10	100
	Eclipse-S/200, 230	16	S	15	50	2/75	2,280	750	3,030	800
	Eclipse-S/250	16	S	35	100	11/78	40	10	50	
	Eclipse-C/150	16	S	55	100	12/78	10	0	10	100
	Eclipse-C/300, 330	16	S	24	115	2/75	950	250	1,200	500
	Eclipse-C/350	16	S	130	180	11/78	20	10	30	
	Eclipse-M/600	16	S	164	210	5/78	50	10	60	100
	Subtotal						37,940	13,230	51,170	
	DCC-112	12	T	3	12	8/70	700	400	1,100	X
	DCC-116	16	T	5	10	11/71	7,450	1,350	8,800	X
	DCC-416/616	16	T/S	3	7	9/75	125	15	140	X
	DCC-Mod 5	16+2	T	3	6	2/76	80	10	90	X
	Subtotal						8,355	1,775	10,130	
	Total						46,295	15,005	61,300	
Datamate Computer Systems*	DM-16	16	T	17	26	11/69	12	0	12	X
	DM-70	16	T	9	15	12/70	25	0	25	X
	DM-70/ROM	16	T	4	6	10/70	NA	0	NA	X
	ECP-18	18	T	14	16	11/66	21	0	21	X
Datum, Inc.*	Enhancer E1/16	16	T	8	15	3/76	15	3	18	X
Digiac Corp.*	3060		T	9	13	1/70	70	20	90	X
	3080	25	T	20	25	12/64	14	2	16	X
Digital Equipment Corp.	PDP-8/a, e, f, m	12	T	4	14	4/71	28,900	12,850	41,750	8,500
	PDP-8/i, l, s	12	T	8	27	5/65	5,765	3,685	9,450	X
	PDP-9, 9L	18	T	35	50	12/66	290	160	450	X
	PDP-11/03, LSI-11	16	M	1	2	6/75	39,650	6,850	46,500	28,000
	PDP-11/23, LSI-11/23	16	M	2		8/79	0	0	0	3,000
	PDP-11/04, 05, 10, 15, 20	16	T	5	16	3/70	21,450	13,500	34,950	3,000
	PDP-11/34, 35, 40	16	T	9	37	1/73	12,800	8,000	20,800	7,000
	PDP-11/45, 50, 55	16	S	24	87	4/72	2,850	1,200	4,050	300
	PDP-11/60	16	S	26	72	6/77	620	600	1,220	1,300
	PDP-11/70	16	S	60	165	7/75	3,500	1,400	4,900	2,400
	VAX-11/780	32	S	128	220	5/78	200	50	250	400
	PDP-12	12	T	13	46	4/69	510	255	765	X
	PDP-15, XVM	18	T	15	82	2/70	550	320	870	0
	Total						117,085	48,870	165,955	
Digital Scientific Corp.	Meta-4/4000	16	S	29	90	4/70	140	15	155	2
	Meta-4/5010	16	S	21	40	10/78	5	0	5	5
	Meta-4/5020	16	T	25	90	4/78	15	0	15	15
	Meta-4/5030	16	S	53	140	5/79	0	0	0	5
Electronic Associates, Inc.	Pacer-100	16	T	15	40	5/72	150	120	270	NA
Foto-Mem, Inc.*	Centaur-100	8	T	6	20	4/70	25	0	25	X
General Automation, Inc.	GA-18/30	16	S	18	50	7/69	2,765	735	3,500	0
	SPC-12	8	T	4	16	1/68	3,132	868	4,000	0
	SPC-16	16	T	5	25	5/70	6,351	2,749	9,100	900
	16/110, 220	16	M	1	3	12/75	1,197	203	1,400	3,000
	16/330, 340	16	T	3	10	1/76	416	34	450	300
	16/440, 460	16	S	9	30	7/75	1,102	448	1,550	800
	16/550	16	S	25	50	3/78	NA	NA	NA	50
	Total						14,963	5,037	20,000	
GRI Computer Corp.	909 Series	16	T	4	9	1/70	320	150	470	X
	99/30, 38	16	T	5	15	6/72	578	268	846	0
	99/10, 18	16	T	3	5	6/72	24	0	24	
	99/40, 48	16	T	6	17	6/72	207	278	485	
	99/50, 58	16		6	12	/74	146	44	190	180
	99/52	16		8	17	/76	7	3	10	
	Total						1,282	743	2,025	
GT&E	Tempo I	16	T	14	36	1/70	160	40	200	X
	Tempo II	16	T	6	10	6/72	2,950	50	3,000	1,500
Harris	6024/1	24	S	69	135	5/69	22	0	22	X
	6024/3	24	S	49	90	2/70	119	0	119	X
	Slash 4	24	S	24	110	8/73	207	18	225	0
	Slash 5	24	S	16	50	5/72	533	24	557	100
	Slash 6	24	S	20	70	12/76	93	4	97	20
	Slash 7	24	S	45	180	10/75	14	1	15	20
	Series 100	24	S	85	190	10/75	86	13	99	X
	Series 200	24	S	179	240	10/75	42	8	50	20
	Series 1X5	24	S	85	175	9/77	92	10	102	115
	Series 500	24/48	S	195	300	12/78	2	0	2	75
	Total						1,210	78	1,288	
Hewlett-Packard	2100A	16	T	7	15	6/71	7,900	3,400	11,300	50
	2100 S	16	T	16	35	8/73	1,825	1,425	3,250	25
	211X/15/16	16	T	9	29	11/66	2,495	1,145	3,640	X
	1000-M (MX-M, K)	16	T	2	15	6/74	4,600	4,550	11,150	1,800
	1000-E (MX-E)	16	T	6	20	1/77	3,400	3,200	6,600	4,500
	1000-F	16	T	12	35	9/78	150	100	250	1,500
	3000 I	16	S	100	185	11/72	1,060	670	1,730	
	3000 II	16	S	100	185	4/76				1,100
	3000 III	16	S	105	175	6/78	160	110	270	
	3000-33	16	S	58		1/79	0	0	0	100
	300	16		35	70	12/78	40	10	50	500
	Total						23,630	14,610	38,240	

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AS OF JANUARY 1, 1979

NAME OF MANUFACTURER	COMPUTER MODEL	BITS PER WORD	SIZE	PURCHASE PRICE ($1,000) BASIC	AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1979 INSTALLATION
HIS-GE/PAC	30	8	T	7	35	5/69	225	50	275	X
	3010, 2	16	T	13	90	5/70	25	1	26	X
Honeywell	112	12	T	5	10	11/69	222	48	270	X
	116/316/416/516	16	T	8	62	10/66	2,405	1,295	3,700	X
	700 Series	16	T	16	65	6/72	1,940	1,520	3,460	25
	164X Series	16	T	144	480	12/69	20	8	28	X
	6/06	16	T	7	42	1/76	)	)	)	)
	6/23	16	T	6		/78	)	)	)	)
	6/33	16	T	4		5/78	)	)	)	)
	6/34	16	T	4	18	1/76	)	)	)	)
	6/36	16	T	4	35	1/76	) 1,950	) 950	) 2,900	) 2,000
	6/43	16	S	7	45	1/77	)	)	)	)
	6/47	16	S	10		8/78	)	)	)	)
	6/53	16	S	14		5/78	)	)	)	)
	6/57	16	S	44		/78	)	)	)	)
	Total						6,787	3,872	10,659	
Information Technology, Inc.*	4900/10	16	T	10	20	10/66	25	0	25	X
IBM	Series/1	16	T	4	25	11/76	3,000	1,000	4,000	7,300
Keronix	IDS-16/8	16	T	4	5	4/74	)	)	)	)
	IDS-16/10	16	T	3	5	4/74	) 1,800	) 50	) 1,850	) 450
	IDS-16/12	16	T	3	4	4/74	)	)	)	)
Lear Siegler	VDP-410	16	T	4	4	10/78	100	50	150	NA
Lockheed Electronics Co., Inc.	LEC-16	16	T	11	18	3/69	2,495	430	2,925	10
	SUE	16	T	6	11	9/72	2,582	408	2,950	400
Microdata Corp.	400	8	T	3	4	1/70	155	0	155	X
	800 Series	8	T	6	11	5/69	2,055	1,380	3,435	X
	1600	8	T	5	11	2/72	8,947	1,647	10,580	1,100
	3200/3230	16	S	8	18	3/74	115	110	225	20
	Micro One	8	M	1	3	11/74	800	120	920	X
	Total						12,067	3,257	15,324	
Minicomp*	MD-708	8	T	5	7	8/70	50	0	50	X
Modular Computer Systems	Modcomp-I	16	T	7	9	10/71	698	142	840	X
	Modcomp-II	16	T	13	40	3/71	2,000	515	2,515	75
	Modcomp-III	16	S	13	44	12/70	72	5	77	X
	Modcomp-IV	16/32	S	48	100	5/74	330	130	460	30
	Classic 7810	16	T	8	60	5/79	0	0	0	180
	Classic 7860	16/32	S	38	100	1/78	102	18	120	210
	Classic 7870	16/32	S	64	150	8/78	9	1	10	100
	Total						3,211	811	4,022	
Motorola Communications Division*	MDP-1000	8	T	8	10	2/68	75	0	75	X
New England Digital Corp.	ABLE Series 40	16	T	8	10	6/77	50	4	54	50
	ABLE Series 60	16	T	10	12	6/78	10	0	10	25
Omnitec (BIT)*	480	8	T	6	17	12/66	195	3	198	X
	483	8	T	9	33	1/70	115	40	155	X
Perkin-Elmer Corp. (Interdata)	1	8	T	4	11	9/70	210	77	287	X
	2, 3, 4, 5	16	T	9	21	5/67	614	153	767	X
	13, 15, 16, 18	16	T	15	33	9/69	14	14	28	X
	50, 55	16+1	T	7	33	4/72	133	40	173	X
	70	16	T	9	65	12/71	1,060	342	1,402	X
	75	16	T	9	38	2/73	300	56	356	X
	80, 85	16	T	16	50	7/72	70	18	88	X
	5/16	16	M	1	5	1/77	134	50	184	150
	6/16	16	T	2	15	1/76	1,117	476	1,593	700
	7/16	16	T	3	18	2/74	3,498	836	4,334	400
	8/16	16	T	4	25	1/77	255	95	350	200
	7/32	32	S	10	35	7/74	933	331	1,264	100
	8/32	32	S	55	160	6/75	423	169	592	250
	Series 16	16	T, S	5		4/79	0	0	0	400
	3220	32	S	34		5/79	0	0	0	300
	Total						8,761	2,657	11,418	
Prime Computer Corp.	100	16	T	6	12	4/73	277	727	1,004	225
	200	16	T	7	22	11/72	365	75	440	80
	300	16	S	12	60	9/73	402	316	718	225
	400	16	S	62	210	6/76	247	103	350	200
	500	16	S	126	330	6/76	)	)	)	)
	350	16/32	S	31	140	/78	15	5	20	NA
	450	16/32	S	35		/79	0	0	0	NA
	550	16/32	S	70		/79	0	0	0	NA
	650	16/32	S	95		/79	0	0	0	NA
	750	32	S	130		/79	0	0	0	NA
	Total						1,306	1,226	2,532	
Raytheon Data Systems	703	16	T	13	23	10/66	179	33	212	X
	704	16	T	10	18	3/70	700	200	900	X
	706	16	T	16	38	5/69	75	17	92	X
	RDS-500	16	S	17	21	12/73	750	200	950	NA
	Total						1,704	450	2,154	
Redcor Corp.*	RC-70	16+2	T	15	30	7/68	100	40	140	X
Sperry-Univac	5901	16	T	6	13	6/68	330	170	500	X
	620/a	16	T		75	12/65	120	30	150	X
	620/f, f-100	16	T	10	23	6/70	470	220	690	X
	6901	16/18	T	10	20	12/65	920	380	1,300	X
	620/L+100C	16	T	5	12	2/71	720	320	1,040	X
	620/L-100	16	T	6	14	6/72	1,030	550	1,580	100
	8620/1, 8622/1	16/18	T	15	29	6/69	175	80	255	10
	V-72	16	T	10	45	2/74	830	390	1,220	150
	V-73	16	S	16	45	11/72	1,190	530	1,720	X
	V-74	16	S	40	80	5/74	210	90	300	X
	V-75	16	S	39	80	8/75	120	50	170	X
	V-76	16	S	8	16	1/76	590	270	860	150
	V-77-200	16	M	2	5	1/77	460	160	620	625
	V-77-400	16	T	5	19	12/76	240	180	420	525
	V-77-600	16	S	8	40	3/77	560	190	750	1,025
	V-77-800	16	S	10	50	7/79	0	0	0	525
	Total						7,965	3,610	11,575	
Systems Computer Corp.*	1000	8	T	1	8	1/71	400	200	600	X
Systems Engineering Laboratories	32/70, 75	32	S	30	80	9/76	90	20	110	100
	32/55, 57	32	S	50	125	8/75	390	140	530	300
	32/75, 77	32	S	70	150	3/78	60	10	70	100
Tandem Laboratories, Inc.	T16	16	S	150	276	5/76	245	80	325	NA
Telefile Computer Products	TCP-16/5	16	T	12	17	/77	5	0	5	50
Texas Instruments	960-A/B	16	T	18	30	12/71	2,800	1,400	4,200	NA
	980-A/B	16	S	17	40	10/72	2,950	1,400	4,350	NA
	990/4	16	M	1	8	6/76	5,500	1,900	7,400	NA
	990/10	16	T	20	25	3/76	4,000	1,150	5,150	NA
	Total						15,250	5,850	21,100	
Two Pi	Two Pi/V32	32		125	125	5/78	15	0	15	NA
Unicom, Inc.*	CP-8	8	T	3	8	2/70	343	165	508	X
Unicomp*	Comp-16	16	T	11	29	5/70	26	0	26	X
	Comp-18	18	T	12	38	8/70	38	0	38	X
Westinghouse Electric	P-50	14	T	16	23	8/64	182	40	222	X
	P-2000	16	T	10	27	8/69	111	90	201	X
	2500	16	T	10	30	11/71	319	105	424	75
Xerox*	CE-16, 16/A	16	T	8	23	6/69	35	10	45	X
	Sigma-2	16	T	24	125	12/66	170	80	250	X
TOTAL							307,037	115,203	422,240	

*) Not currently active in manufacturing or marketing minicomputers.
NA) Data is not available.
X) Indicates minicomputer models not in new production.

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• THAT IBM TRIAL (REMEMBER?) COULD BE DELAYED "YEARS," says trial counsel Thomas Barr over a ruling by Judge David N. Edelstein that will require IBM to produce documents to back up testimony by Chairman Frank Cary. IBM contends that such mid-trial discovery, besides unearthing some highly sensitive information, could cost $1 billion and take 62,000 man-years to collect. The defendant argues that a long delay of the trial will be necessary . . . to which, of course, the Department of Justice, objects. The case, begun in 1969, went to trial in 1975.

• SPEAKING OF TRIALS, THE TRAIL ENDS FOR CALCOMP . . . since the Ninth Circuit Court of Appeals has upheld a lower court decision against Calcomp in the company's $300 million antitrust suit against IBM. The court said it found no substantial evidence that any of IBM's acts were unreasonable.

• MA BELL MAY YET GET TO PLAY HARDBALL IN THE EDP BUSINESS, depending on the final results of the Computer Inquiry II. "Tentative" results have the FCC redefining the hybrid EDP-Communications market into 5 categories: 1) voice ervices, 2) nonvoice services, 3) "enhanced" nonvoice services, 4) simple station equipment, and 5) sophisticated equipment. AT&T would be allowed to compete, if the "tentative" ruling is accepted, in the controversial areas (3 and 5) by means of arm's length subsidiaries. Tariffs would be optional . . . which would presumably allow the regulated carrier to bypass the constrictions of a 1956 consent and decree barring it from unregulated businesses.

• ACTIVITY IN BUBBLE MEMORY CONTINES TO BURBLE as Rockwell signs pacts with both Burroughs and Siemens concerning the avant garde memory technology. In the first, Rockwell will exchange information and assistance with Burroughs; in the second it signed a second-source agreement. Over a period of five years, Rockwell and Siemens will also exchange certain future products.

• BUT THAT DOESN'T MEAN DISK IS DEAD . . . why, just recently Memorex announced a double-density version of its 3350 equivalent, the 3650. The new model, the 3652, is a dual-spindle system with 635 MB per spindle. Thus, one module supports 1.2 gigabytes; and a standard configuration includes four modules ($191,000) . . . with a resultant cost of .004 cents/byte.

• PUT YOUR NAME IN THE 4300 HOPPER? GOOD LUCK. IBM has announced the delivery schedules and they are long (IDC has a 3-year wait). Multiple orders have been spread out, too, especially affecting leasing companies.

• FROM THE PCM-CPU FIRMS: THERE IS LIFE AFTER THE 4300 . . .although until IBM announced its delivery dates for the E-series on June 18 there was a lot of uncertainty. Itel, for instance, had to realign its computer operations in the face of first half losses, but now the company says it sees renewed activity. (Itel is pushing short-term leases and prepping for two new models to take advantage of long 4300 lead times.)

Amdahl, which expects a break-even 2Q, says it is still in there kicking, albeit with a higher lease/purchase ratio than it might have hoped. Blood relative Magnuson Systems, on the other hand, is almost ebullient . . . having capped a $10 million private funding deal on the day of the IBM announcement and joined in a marketing program with Boothe Computer Corp.. National Semiconductor, however, has withdrawn its System/400 from the market to rework it into a less expensive system.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" JULY 18, 1979 • VOL.15,NO.4 P.J.McGOVERN, PUBLISHER

Texas Instruments opens the flood gates

DESKTOP COMPUTER VENDORS SEEK TO AVOID CRUNCH BY COURTING THE SMALL BUSINESS MARKET

Ironic. The product that stole the spotlight at NCC . . . wasn't at NCC. It was in Chicago. The object of this unrequited interest? Texas Instrument's new 99/4 consumer-oriented desktop computer. After the press build-up surrounding TI's unsuccessful attempt to get an FCC waiver for its forthcoming "home" computer designed to hook up to a TV screen, NCC conventioneers eager for a first-time look at the rumoured 99/4 were disappointed to find only a small brochure and no computer. TI snubbed NCC in favor of the Summer Consumer Electronics Show in Chicago.

The 99/4's absence from TI's NCC exhibit is less surprising, however, in light of reports that in-fighting between the firm's Lubbock-based Consumer Products Division and Austin-based Digital Systems group has resulted in Austin's gaining control over any more powerful systems with Lubbock holding onto only the 99/4 and a likely TV-hookup system to be introduced pending FCC clearance. Thus, Austin was not eager to let the 99/4 grab the spotlight at the expense of its own products.

But enough politics. What of the thing itself? TI touts the 99/4 as "the first true home computer . . . designed to be used by individuals with virtually no knowledge of computers." The keys to the ease of use are the solid state ROM modules that allow users to access programs simply by plugging them in. Each displays step-by-step instructions on the screen and contains up to 30K bytes ROM memory at prices from $19.95 to $69.95.

The $1,150 consumer product (originally conceived without a video monitor at less than half the current asking price) consists of a typewriter-style keyboard housing a 16-bit "9900" microprocessor, 16K bytes RAM and 26K bytes ROM (plus the 30K modules), and a 13" color monitor (24 lines of 32 characters). Special features TI feels make it unique:

- Sixteen-color graphics on the 13" monitor.
- Music and sound effects which allow users to build with simple commands three-note chords in a five octave range variable by frequency, duration and volume.

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- A built-in equation calculator which assists users with everday math and complex scientific calculations.

- An optional speech synthesis accessory (related to TI's Speak & Spell learning aid) that provides verbal prompts and other messages. Hundreds of words can be called up from several plug-in vocabulary modules, priced about $150.

TI categorizes the software, only some of which is available now, as falling into four areas: personal finance, home management, education, and entertainment. Titles now planned are Household Budget Managment," "Home Financial Decisions," "Beginning Grammar," "Early Learning Fun," "Number Magic," Physical Fitness," "Video Chess," "Football," and "Video Graphs."

Accessories to be offered with the 99/4 in the near future will be a printer, disk memory and an RS-232 interface device. For game playing, two joy sticks with side-mounted "fire" buttons can also be hooked up.

Reaction to the TI introduction has been predictable. Mike Markula, vp and board chairman of Apple, maker of Apple II and Apple II Plus computers which sell in a price-range slightly above that of the 99/4, says: "Their product is not as good as I had expected," but goes on to say that it would help the market by increasing consumer awareness of home computing possibilities. Radio Shack echoes this sentiment.

As for a need for price cuts from competitors to counter the impact of the 99/4, Chuck Peddle of Commodore, maker of the low-priced "pet" computer, felt there was no pressure to do so, either from a competitive or inventory standpoint. However, Radio Shack has recently dropped the price of its TRS-80 to $500 (a $100 drop). Also, Apple's product marketing manager, Phil Roybal, has noted that dealers are starting to shave margins and that manufacturers, including Apple, are adding new features while holding prices steady.

New fashions for business wear unveiled at NCC

TI's 99/4 may have stolen the show in the print media prior to and during this year's third annual pilgrimage, but nearly everyone who is anyone in desktop computers had something new to show off to the business community. The new look generated a lot of interest from swarming spectators. The list, as well as the bang-for-the-buck offered, is impressive.

A sampling from the multitude:

- The award for "Best Booth" at the personal computing exhibit would have to go to Apple. It was an eye-catcher, drawing heavy crowds all week. The Apple II, a high-end hobbyist computer turned business system, was on display, along with the Apple II Plus, which exploits the computer's business potential. Options included a plug-in language card for Pascal, color graphics, and an RS-232 communications interface.

  Service for Apple computers will be provided in the form of a 90-day warranty, a network of 500 dealers, and a "hot line" for emergencies. Levels of service are available from local/onsite to factory repair. In addition to its own dealers, Apple offers

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C-3PO WHERE ARE YOU?

If the exhibition of robotics technology put on at the Personal Computing show held at the Sheraton is any measure of the current state of the art, Starwar stars C-3PO, R2D2 and the Cylons of Battlestar Galactica will remain only celluloid figments of Hollywood's imagination. This is no putdown of those who displayed their microprocessor-based wares, rather it is a statement of how incredibly difficult it is to make a robot that truly "thinks" for itself in an uncontrolled environment.

Nowhere was this more graphically evident than in the "Amazing Micro-Mouse Contest" held at the Sheraton. The task prescribed for entrants in the IEEE-sponsored contest was to build a self-propelled, computerized "mouse" that could find its way through an 8' by 8' maze in the fastest time. The reward: $1,000. Across all levels of "intelligence", the common element was the robots' propensity for breaking down, much to the chagrin of their proud creators. Time and again, micro-mice would charge through a few feet of maze only to knock themselves "senseless" against a wall. The results were impressive, though, when all was running smoothly. The "Moonlight Special", for example, was able to "learn" from experience and significantly improve its time on its third run through the course.

The conclusion to be reached is that as yet -- at least for dedicated applications -- robots are not so much limited by intelligence as by mechanical reliability. (Indeed, Frost & Sullivan predicts that the industrial robot market "will soar to $438 million by 1985".) As for androids of C-3PO's ilk, intelligence (as well as mechanics) is a real problem. To date, even the most powerful computers in the world are unable to outwit a master in the game of chess. And life, as we all know, is many times more complex.

dealerships to audio stores, and has signed up Bell and Howell to market an education-oriented system.

Apple projects a hefty $100 million in shipments for 1979, up from $200,000 in 1976. Targeted are home professionals and small businesses looking for their first computer . . . in a price range above TI or Radio Shack's Model 1.

- No look at the market would be complete without a glance at Radio Shack's TRS-80 Model II. Operating at twice the speed of its "little brother," it starts at $3,450 for 32 KB RAM and half a megabyte of built-in disk storage. Model II runs Basic and the TRSDOS operating system (which takes 24 KB of the RAM).

  Software now available includes General Ledger, Inventory Control, Payroll, and Accounts Receivable and Payable. Three-disk versions are reputedly in the works, which would allow for the transfer of account journals into the General Ledger system. Service will be provided at Radio Shack's 53 computer stores (50 more by 12/79) and at 73 repair centers across the country.

- Here's a Horatio Alger story . . . what started out in August 1976 as a modest attempt to market a home-designed memory board has

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blossomed into Vector Graphic, a 100-employee company with sales anticipated over $17 million this year. And while the company still offers a slew of boards and other hobbyist hardware, it has been focusing efforts on developing a small business system since the TRS-80 was announced.

Of particular interest is the new Memorite WP/DP system ($9,000) intended for first time user businesses in the $100,000 to $1 million sales bracket. For word processing applications, Memorite 2 provides advanced text preparation and editing like that on a Wang 5-2 or a Vydec 1400. The price includes a Qume printer.

As a data processor, Memorite 1 can perform all the standard accounting functions and custom applications written in Business Basic. Vector Graphic plans to market the system through its dealer network, but hasn't ruled out a dedicated sales force if business demands it. Service will include visits to sites by dealer repair experts, as well as an emergency "hotline."

- At the high end of the spectrum is Cromemco. Especially interesting: its top-of-the-line System Three Multi-User and the Z-2H Hard Disk Storage Computer Systems. The former uses a fast Z-80 micro and can support from 2-7 workstations, each with 32 KB of RAM. Up to a megabyte of disk storage can be supported . . . and a full-blown system, with printer, etc., costs $15,000.

  The Z-2H system features an 11 MB hard disk with a transfer rate of 5.6 MB/second. A second disk can be added. Two floppies, up to 512 MB of RAM, and an RS-232 interface are also provided. Here again the price hovers near $15,000.

  Software packages include a disk os, Cobol, Fortran IV, Basic, and word processing -- which Cromemco feels will put in competition with "the big boys." The firm has a dealer net of 500, no plan for a dedicated sales force. Its next product: A DDP system.

The market according to USC

Statistics on the personal/desktop computer market are elusive. International Data Corporation is in the midst of an in-depth study of the market, but results won't be available for several months.

In the meantime, EDP/IR turns to academia. Presented as part of the proceedings of the Personal Computer portion of NCC, Paul Gray and F. Roy Carlson of University of Southern California (USC) have completed an initial phase of a study of the market.

Their technique is built around the "Bass" mathematical model for predicting sales of consumer products, particularly big ticket items. Bass was able, for example, to calculate "the peak in the sale of color television sets to first-time buyers."

Carlson and Gray have since found that sales data for electronic calculators obtained from the March, 1978, issue of Merchandising magazine closely fit the Bass model as well.

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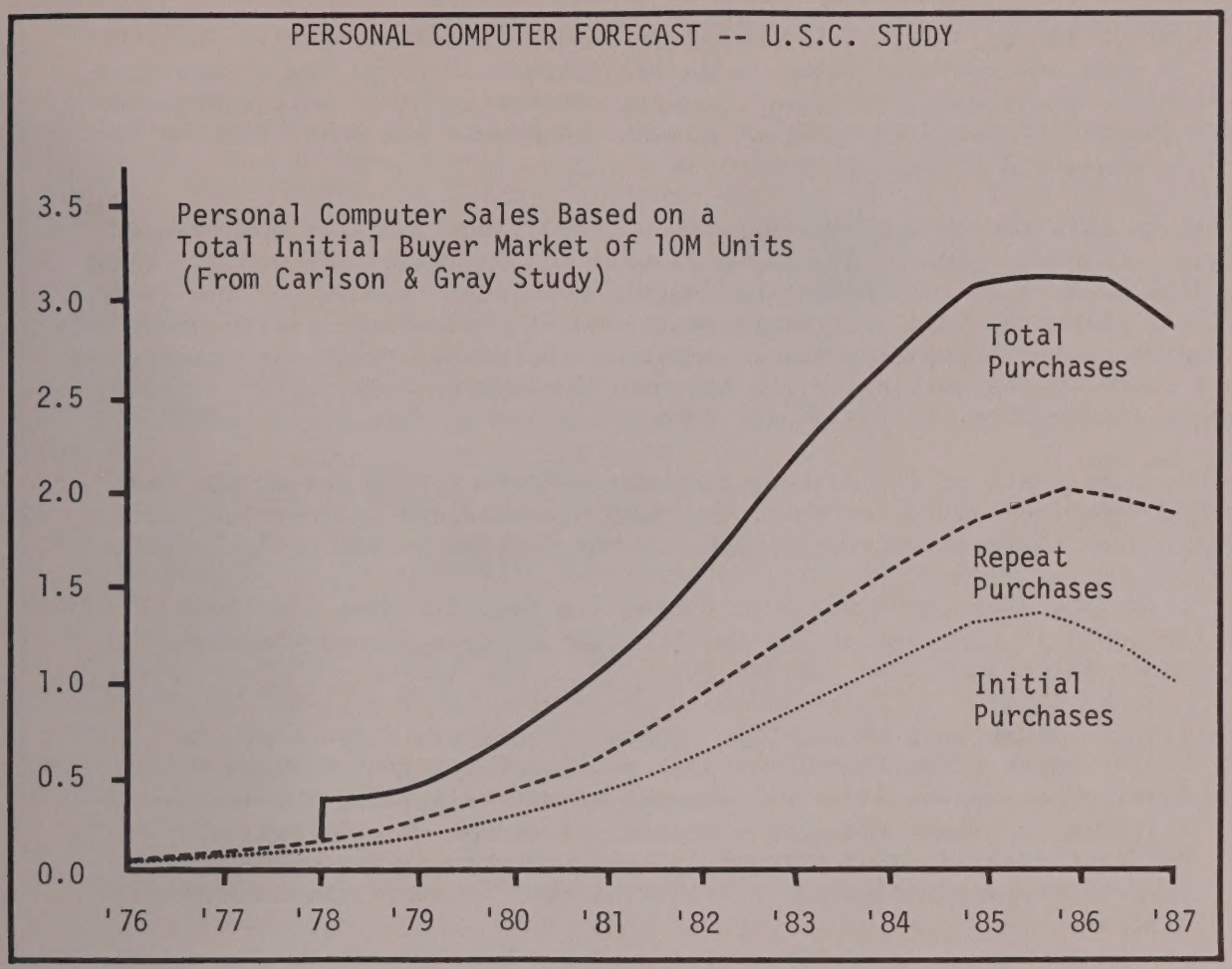

Using data obtained from a variety of sources, and while acknowledging that they had no uniform definition to work from, the two have made a conservative estimate of the desktop sales for 1976 and plugged the figure into one of their byzantine equations (IDC estimated this base figure to be 23,700 in a July, 1977, report). The resulting projected 83% compounded growth can be maintained for a few years, they say, but not for ten as some project (and no other consumer product has). Thus they doubt forecasts of 100 million units in a ten year period and feel the initial sales growth will peak around 1985, with the replacement market predominating thereafter.

Carlson and Gray, then, forecast a total market of roughly 60 million units by 1980, 43 million to private homes, the rest split evenly between large and small businesses. Based on a 3-year replacement cycle (comparable to office equipment), they predict annual sales of desktops for business of 6 million by 1990.

EDP/IR's analysis . . . through the NCC looking glass

The contrast between the decidedly business-oriented exhibits and the "blue sky" tenor of the Personal Computing proceedings, was a perfect microcosm of the skitzoid nature of the computer industry's fastest-changing segment. At one end of the spectrum were "The Amazing Micro-Mouse Contest" and visionary assessments of personal computing's impact on society; at the other were former hobbyist firms Vector Graphic, Ohio Scientifc, Cromemco and the like making an all out plunge into the small business market.

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Clearly, the majority of the speakers and their audiences were not interested in what desktop computers can do for business. There are no new frontiers in the small business market, only a restructuring of price/performance curves for users; the dreams of socio-economic bounty are what stir the "new left" in the world of computing.

But in this tug-of-war between economics and sentiment, economics must prevail. Desktop vendors, if they ever were out to change the world, cannot afford to dream right now -- in the immediate future, the name of the game is survival. Like the Lone Star State cattlemen of yesteryear seeking new chunks of open range and stampeding homesteaders in their way, Texas Instruments has joined Tandy in the battle for the consumer's computer dollar . . . leaving precious little room for the family farm.

Thus nearly all of the desktop computer vendors EDP/IR saw at NCC have donned three-piece suits (or their feminine equivalents) and circled their wagons around the small business market. The picture is not entirely grim:

- Desktop vendors have not been caught flatfooted. Most have been actively gearing up for the small business market since the day Radio Shack announced the TRS-80.

- Though all agree a shakeout is coming -- some say as soon as six months hence (Processor Technology and Xitan are recent casualties) -- the shift from the consumer market will delay the inevitable for some, and give all a better chance of survival. Not surprisingly, many firms foresaw a scenario in which their competitors went under, a variation of the "it won't happen here" syndrome.

- When a company the size of Texas Instruments enters a new market, people notice. So while TI will grab a hefty share of the market, its tacit approval of the concept will expand the market overall. (The IBM endorsement theory.)

- Though desktop firms will increasingly be taking on established mini makers as the capacity of microprocessor-based systems increases and costs continue to drop, firms reaching up to the low-end mini market will have the edge on those reaching down because dealer networks will be more economical than dedicated sales forces -- and those who survive will necessarily have a strong dealer net.

- Aside from marketing/distribution problems mini makers will have in squashing the desktop invasion, desktop vendors expressed the belief that mini makers' unwillingness to disrupt their own price/performance curves will offer them shelter.

- As for a threat from below by Radio Shack's TRS-80 Model II, one desktopper offered the opinion that RS's identification with low-end everything -- not just computers -- will hinder it in the business market, opining that "you're not going to buy a $15,000 system from the same guy you buy batteries from."

So much for the positive side of the picture. What problems will desktoppers have to overcome if they are to make the cut?

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THE WORLD AT YOUR FINGERTIPS

The problem that "home" computer manufacturers have been wrestling with since the days of the MITS Altair is how to make operating one of the little devils painless and rewarding enough to make them attractive to the general public. The Telcomputing Corp. of America's answer to this problem is called "The Source," which, through the use of a modem and keywords, allows users of a dumb terminal or a desktop to access vast amounts of information. By dialing a toll-free number, users can access the U.P.I. and N.Y. Times data bases, the Dartmouth College Educational Library (offering a myriad of courses at many levels), Consumers Union information, make reservations for tickets and transportation, play games, get help fending off the IRS and more. TCA's data base now has over 3,000 programs to call up as well.

Customers will pay a $100 initial hook-up fee plus $2.75/hour for non-prime time use (6:00 p.m. to 7:00 a.m.) and $15/hour for prime time (7:00 a.m. to 6:00 p.m.). The billing mechanism will direct charges to credit cards timed to the nearest minute. Unlimited storage is also provided for 3.3¢ per 2,048 character block/day.

The McLean, VA firm plans to sell about 200 franchises nationwide (40¢/maildrop) in return for a share of the action. A door-to-door sales/demonstration campaign is planned to drum up subscribers.

- With the cost of components being roughly the same for all the little guys out there, margins are going to be tight at the more price-conscious low end. Thus skillful management of production and distribution will be critical, the very areas where Radio Shack and Texas Instruments have the advantage. Remember the calculator.

- Any successful move into the small business arena will entail garnering a strong dealer net trained to maintain a firm's line. Competition for prime locations will be tough, as stocking lines that do not sell briskly will be costly for dealers. Firms forced to offer discounts and territorial rights will lag.

- While the software picture has improved over the last year or so, it's still a stumbling block for many vendors. Once past the immediate problem of package selection, users may still need to modify them. With (Basic, Fortran, Cobol, Pascal, etc.) next-to-impossible for nonprogrammers, users that cannot find a suitable standard package will end up spending a lot for modification.

  (The desktop software scramble presents a lucrative opportunity for the systems house crowd; a distribution channel that may eventually outgross dealerships in small business sales.)

- Some components are in short supply -- especially for small firms without quantity leverage to muscle parts from OEMs. Floppies in particular have been hard to find, forcing some firms to go dual density or to 8" disks because they could get nothing else.

Meanwhile, the quest continues . . . to bring home computing into businesses, and business computing to the homes.

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• CBEMA TO UNCLE SAM: HANDS OFF! . . . at least when it comes to enlarging the Department of Labor's application of federal rules about "wage busting" for low paid workers to the computer industry. The rules, which CBEMA says were designed to protect low-pay custodial and food-handling employees, would apply to DP and Telecom companies having business under contract with the government. The DOL would like the rules to extend to computer service technicians . . . which CBEMA and at least one influential Congressman (Jack Brooks -- D, TX) says would disrupt the industry.

• BELEAGUERED ITEL UNCASES SOME NEW AMMO, and high caliber stuff it is, too. The new Hitachi-built additions to Itel's line of PCM CPUs top off the company's line in the 3033 and higher range . . . bringing Itel into competition with the other main PCM CPUer, Amdahl. The smaller of the two models is the AS/7 Model 7033 Dual Processor -- a $3 million system that outperforms the AS/6 by a factor of 1.8 and equals or betters the 3033.

The larger system, the AS/8 Model 7034 -- which Itel is waiting to price until the IBM "H" Series debuts -- is rated by the company as 1.6 times as powerful as an AS/7. This system comes with some new 550-gate LSI circuitry and ultrafast bipolar RAMs and a new remote software and technical support service. Itel hopes the systems will buttress its line (already macerated by the 4300) against IBM's "H" Series, which Itel thinks will come in 2Q 1980.

• INCOTERM IS INGESTED, as Honeywell folds it into a new Airline and Financial Industries Division made up of (1) the financially-oriented parts of the old Incoterm and Honeywell's financial products and (2) what's left of Incoterm. The move continues a Honeywell push to market along industry lines.

• CONGRESS THROWS IN THE TOWEL AT A COMM ACT REWRITE . . . otherwise entitled, "If Van Deerlin can't do it, nobody can." Indeed, the chairman of the House Communications Subcommittee who launched an effort to rewrite the Communications Act of 1934 (after the Bell Bill was blunderbussed into solonic consconscious, Lionel Van Deerlin (D-CA), says he has given up. Congress just isn't interested. Instead, the legislator proposed a revision of the structure of the common carrier industry wherein AT&T would have to market new services via separate subsidiaries and competitors would be free to compete with AT&T's old services. (Western Electric would still be AT&T's manufacturing arm and would need separate subsidiaries only to market, not make, new competitive equipment.)

One of the main reasons for abandoning the gallant effort is that no one could agree (or compromise) on what the restructured industry should look like, including the broadcast and CATV areas. The major change is that now that disagreement will focus on the common carrier arena. Who said Congress isn't a far-thinking body politic ready and eager to accept its responsibilities?

• THAT CLANKING OF CHAINS IN THE CLOSET THAT NO ONE LIKES TO HEAR, to wit, computer misuse, is the subject of a recent report by the American Institute of Certified Public Accountants (AICPA). A guideline for auditors -- who more and more are being dragged into the examination of controls against computer abuse -- the report sets down the parameters for guarding against computer shenanigans. The report's title: "Controls Over Using and Changing Computer Programs," AICPA, 1211 Avenue of the Americas, New York, NY 10036.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" AUGUST 6, 1979 • VOL.15,NO.5 P.J.McGOVERN,PUBLISHER

4300 Fallout -- p.2; S/1 forecast -- p.6

IBM STUNS U.S. CASE COURT JUDGE ASKS OUSTER FOR "BIAS AND PREJUDICE"

"The Justice Department case is being tried before Judge Edelstein, very eminent and very experienced. He heard the 1952 case against IBM, approved the 1956 Consent Decree, and has supervised its enforcement and compliance. He is thoroughly familiar with IBM, knows more about EDP industry than any other Federal Judge, and surely recognizes the present case not only as the largest of his career but probably the last big one." -- EDP/IR, December 29, 1972

"And time may well be the DOJ's most ruthless foe. After a while in such a long drawn out affair a certain entropy must take hold. Memories dim, papers dissemble, staffs turn over, expertise dissapates, and motivations flag." -- EDP/IR, February 27, 1975

It was a well-staged drama. On July 9, IBM lead attorney in the U.S. case, Thomas Barr, entreated Judge Edelstein to allow an unprecedented mid-trial recess . . . with the purpose of allowing a panel of IBM lawyer-directors to act as the client's legal brain. The judge had just ruled that IBM would have to dish up the paperwork to back up Frank Cary's scheduled court appearance -- paperwork IBM claimed would cost over $1 billion and take 62,000 man-years to produce. The special lawyer-director committee within IBM would, said Barr, make decisions in this matter and others for IBM. It would shorten the trial.

The judge acquiesced, musing that IBM might decide to rest its case, talk settlement, or refuse to comply with the Cary order. He gave IBM 10 days.

Then, on July 19, Barr revealed the method for shortening the trial: to wit, he requested Edelstein remove himself from the case and appoint a new judge. A visibly shaken Edelstein had no comment, but requested the DOJ draft a reply. If Edelstein refuses the request, IBM will undoubtedly appeal.

The unusual request was brewing within IBM for some time -- at least the number of pages and binding of the request document indicate so -- and the lawyer-director meeting must have been a risk-analysis session. EDP/IR, which considers itself a neutral but highly interested observer, notes:

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- IBM has gone up against Edelstein before. In the fall of 1975 IBM disputed some of the Judge's motions (EDP/IR, Nov.6,1975). An appellate court upheld IBM and issued a "writ of mandamus."

- The removal of Edelstein would delay the trial. To EDP/IR it would almost make it impossible for a follow-on judge to try . . . there are just too many documents and transcript pages to read.

- The DOJ staunchly defends Edelstein. It could be because of the delay factor -- or Edelstein's treatment of the government.

- IBM's success at the appellate court level has been excellent (Telex, Greyhound, CalComp, Memorex).

One thing's for sure. The IBM move brings the slower-than-realtime case back into the public consciousness again. Since its opening in May, 1975, its pace and the minutae of its substance had inflicted most of its observers with a bad case of the "yawns." At least it's not boring anymore.

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AMDAHL, ITEL ANNOUNCE NEW PCM COMPUTERS; AMDAHL AND MEMOREX TALK MERGER AS THE 4300 CONTINUES TO CUT A SWATH THROUGH IBM COMPETITORS

The plug-compatible CPU makers, led by Amdahl and Itel, have seen their marketplace horizons considerably darkened since the announcement of the 4300. During the long period between IBM's January product announcement and July delivery schedule announcement, times were especially tough:

- Itel expects a second quarter loss of $60 million, has had to lay off people and realign management, is renegotiating delivery commitments from National Semiconductor and Hitachi.

- Amdahl's earnings have flattened because of cash flow problems generated by higher-than-expected rentals and leases (vs purchase), and the company is now talking with Memorex about merger.

But the companies are still in there swinging . . . primarily with the announcement of new products. Amdhal's is a new midrange 470V7, dubbed the 7A, that fills the gap between the V6-II and the V8. According to Amdahl, the 7A is about 80% as powerful as the V8, which means it's about 16% more powerful than V6-II. Since the machine costs $3.4 million in minimum configuration, it represents a price increase of under 6%.

Amdahl's other product, called the 470 ACCELERATOR, is a black box that attaches to an Amdahl 470 V5, 5-II, or V7A computer and offers -- on command -- up to 50% more CPU power. When the device is being used Amdahl will charge $90 an hour (minimum 20 hours); when it's not being used there is no charge beyond the minimum $1,800 a month.

(As the EDP/IR sees it, the accelerator involves a trade off -- since using it 24 hours a day, 7 days a week would cost $65,000 in monthly rental. A V5-II rents for about $45,000 a month, according to figures published in Computerworld, and can only be accelerated by 45%. According the the EDP/IR calculator, if a V5-II is used much more than 225 hours/month and has the accelerator on all the time, costs outweigh advantage.)

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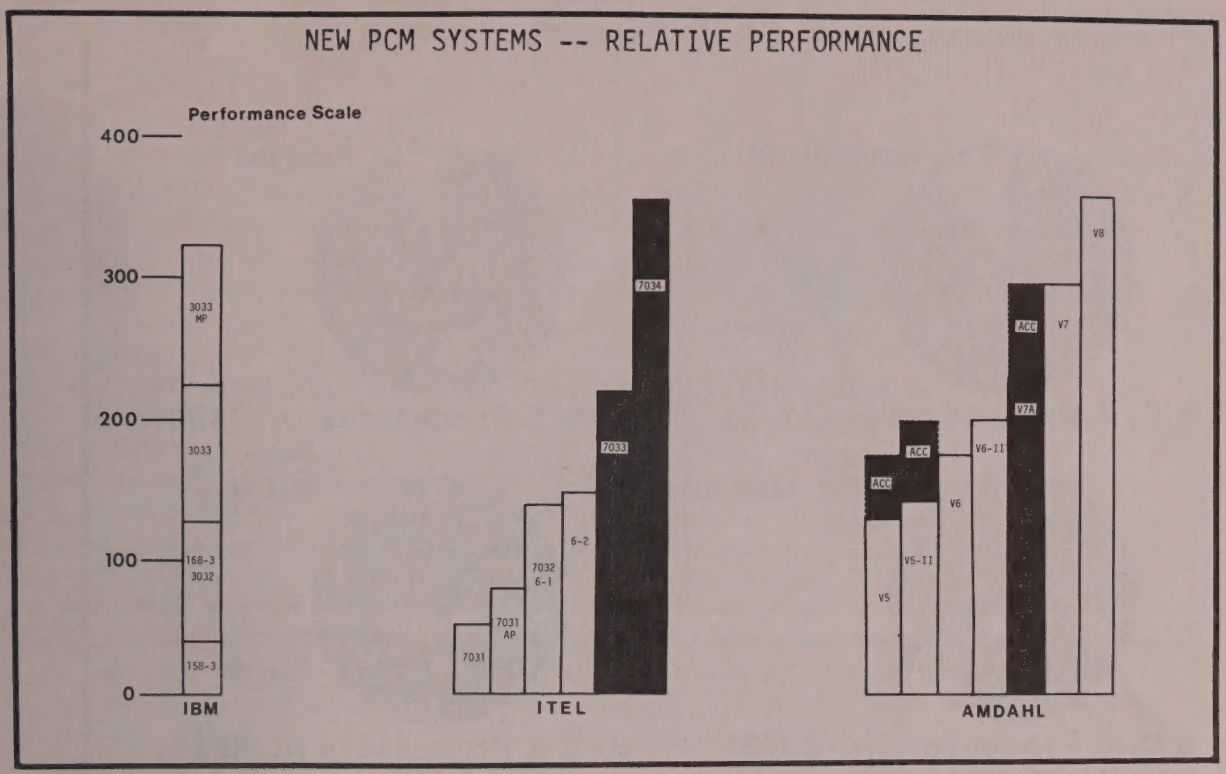

Itel's new products, the AS7 Model 7033 Dual-Processor and the AS8 Model 7034, extend the company's product performance range to well over twice what it had been. Made by Hitachi, the new systems go up against the IBM 3033 and not-yet-announced "H" Series (Itel is holding off on pricing the 7034 until "H" is announced). The 7033, which can operate as either a tightly-coupled multiprocessor or two interconnected uniprocessors, can come with anywhere from 4 to 16 MB of main memory and 12 to 16 channels.

The 7034 can also come with 4-16 MB of memory and 12-16 channels, but features new 550-gate LSI chips, which enable the system to have a 42 nanosecond processor cycle time and 100 nanosecond main access time.

Bucking the H Series

The problem for the PCM CPUers -- and a substantial portion of the rest of the computer industry, including IBM -- is not so much the E Series (4300) as the H Series. Although it's not yet been announced -- and industry rumors see IBM bringing it out anywhere from 6 to 18 months from now -- this "phantom" system has led users and vendors alike to rethink their position:

- Users waiting for the H Series are opting for rental and short term leases for their current equipment . . . leading to cash flow problems not just for the PCMers but for IBM as well.

- National Semiconductor is "rethinking" its System 400; Itel has dropped plans to manufacture its own system; Multiprocessors Inc., formerly Citel, has withdrawn two medium-scale models. Other PCM CPU makers have relabeled products or announced new ones.

- Add-on memory makers have found themselves in a price war (as low as $30,000 a megabyte, according to trade press reports) spurred by the

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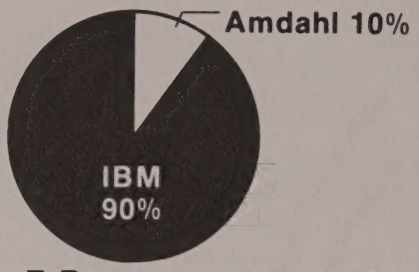
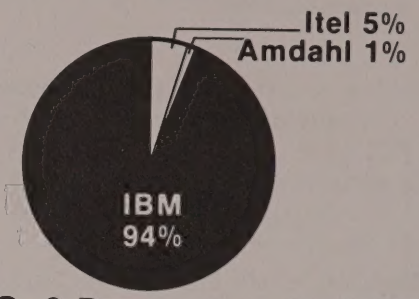
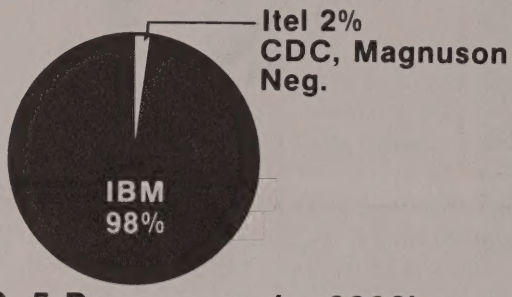
PCM CPU PENETRATION OF THE U.S. MARKET -- UNITS AT 12/78



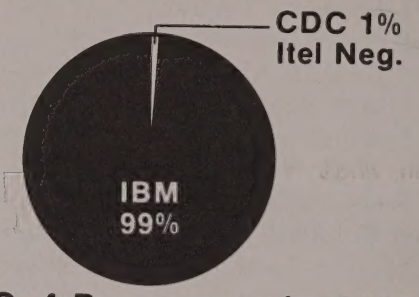
S.C. 7 Processors (n=1172)



S.C. 6 Processors (n=2889)



S.C. 5 Processors (n=3383)

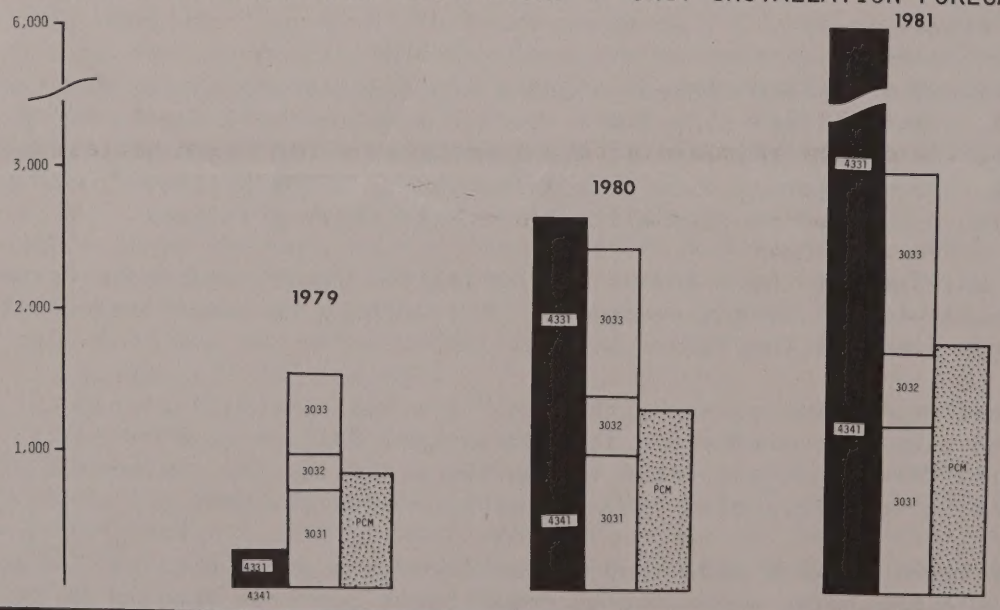


S.C. 4 Processors (n=6888)

If you see IBM pricing strategy as a reaction to competition, then the 4300 price performance makes sense . . . PCMs were gaining just too much of a foothold. The biggest dent, however, is in the largest size class, where IBM was constrained by a 303X it may have been forced to announce early and now can't supersede too soon. The H Series should effectively bind the top size classes.

*S.C. means Size Class. For a ranking of computers by size class see the General-Purpose Computer Census, EDP/IR, June 30, 1979.

PCM CPUS AGAINST THEIR IBM COMPETITORS -- UNIT INSTALLATION FORECAST



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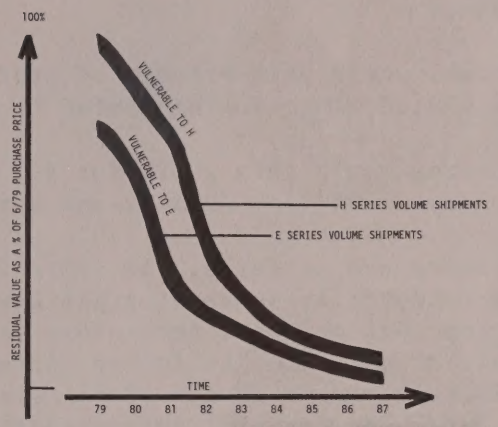
HOW RESIDUAL VALUES CHANGE OVER TIME

The residual value of a computer drops over time, in general remaining fairly high until IBM starts volume shipments of its replacement systems.

The curves to the right show this. The systems competing with the 4300 (E) will see the most drastic drop in residual value between 1980-81. Those competing with the expected H Series will start dropping a year to a year and a half after that, with the nuances of the actual rate of change depending on what H Series brings.



by the $15,000 per megabyte prices announced with the 4300s. New competitors from the semiconductor industry have added to the already strong pressure. Cambridge Memories, for instance, just posted a $170,000 loss for its latest quarter; EM&M also reported a down quarter. Memorex is tailing off its emphasis on add-on memory . . . just as National Semi has moved to market end users.

- The leasing industry is abuzz with talk about Lloyds of London, which stands to lose more money in contracts underwritten in the computer industry than Hurricane Betsy, its biggest loss to date. In some cases Lloyds has allegedly reneged, claiming lessors haven't sought out second lessees aggressively enough. IDC has identified at least 10 companies with Lloyds insurance; but only 10% of the systems in a recent sample of 231 machines were insured by Lloyds, according to their users.

- Residual values for 4300 competitors -- and future H Series competitors -- have dropped more than expected. The reason: the 4300s and their memory increments were more aggressively priced than expected. Even IBM didn't forecast the user demand that would develop . . . or how it would affect expectations for the H Series.

According to IDC research, the PCM CPU makers are especially vulnerable to the type of price performance changes wreaked by the 4300 and expected for the "Phantom" H . . . because users base their buying decision primarily on price. From an IDC study: 52% of PCM users chose PCM CPUs because they cost less, 9% because delivery schedules were better, 7% because of of better price performance. The rest chose PCM equipment for a variety of reasons, including type of cooling system and space requirements.

Making Amdahl Strong

While Itel has chosen a management realignment and cost cutting to buttress itself against the E and the H Series, Amdahl has found another line of defense . . . possible merger with Memorex.

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In a press release dated August 2, Memorex and Amdahl announced that just such a deal was under discussion. It was later revealed that the merger would entail a swap of stock -- 1 Memorex for every 1.2 Amdahl -- worth at present rates about $235 million. Annual revenues for the two companies are over $1 billion, 1978 earnings were about $100 million. In some respects the merger makes sense:

- Amdahl would gain breadth of product line, the communications vendor it wanted since losing Comten to NCR, and more overseas exposure.

- Memorex would gain a CPU for all its peripherals, the advanced technology of Fujitsu-Amdahl, and a ready-made CPU base to ply.

But there are pitfalls. If IBM got aggressive in one area and not the other, a potentially successful partner could be pulled down . . . there is speculation that new disk technology is soon to come into vogue; there is the H Series. At any rate, to future historians an Amdahl-Memorex merger would certainly come across as one of computerdom's milestones of the 1970s . . . whether for good, for ill, or for naught.

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AFTER A SLUGGISH START IBM'S SERIES/1 PICKS UP STEAM
IBM SERIES/1 REVENUES TO HIT $200 MILLION THIS YEAR, $1.4 BILLION BY 1983

After the first splash made by "Peachtree" in November, 1976, IBM's Series/1 minicomputer seemed to do the "dog-paddle" in the marketplace. Estimates of Series/1 penetration had IBM shipping 7,000 units in 1979 and raking in over $400 million in revenue from them.

It's not quite been the case, says IDC, publisher of EDP/IR. While 1979 will see 7,000 Series/1s shipped, revenues to IBM will be about $200 million . . . average system value is lower than analysts once thought. IBM's minimum support and software for the S/1 propelled it past the total end user market to the third party market and the large end user market.

(OEMs, says IDC's report "The Acceptance of Series/1," shun the Series/1. IBM's volume discounts just aren't enough. In 1979, IBM's OEM Series/1 revenues will be under 20% of the total -- compared with 42% for the mini industry as a whole. By 1983 OEM revenues might be as high as 25%.)

Still the Series/1 has not been a loser. In two years IBM has made it into the top ten of mini suppliers, this year it may take it into the top five. And the IDC report sees 1979 and 1980 as watershed years for the Series/1 -- shipments will more than double each year.

Some of the fuel heating Series/1 steam:

- Software has finally been provided at a decent level; volume discounts have been instituted to entice large end users and third-party suppliers; Series/1 has been ushered into the SNA fold.

- Additional peripherals -- tape, diskette magazine, hard disk, multi-line controllers -- have been added.

- IBM has encouraged independent suppliers -- especially software packagers -- to participate in the Series/1 market.

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WORLDWIDE SERIES/1 REVENUES/SHIPMENTS 1976 -- 1979

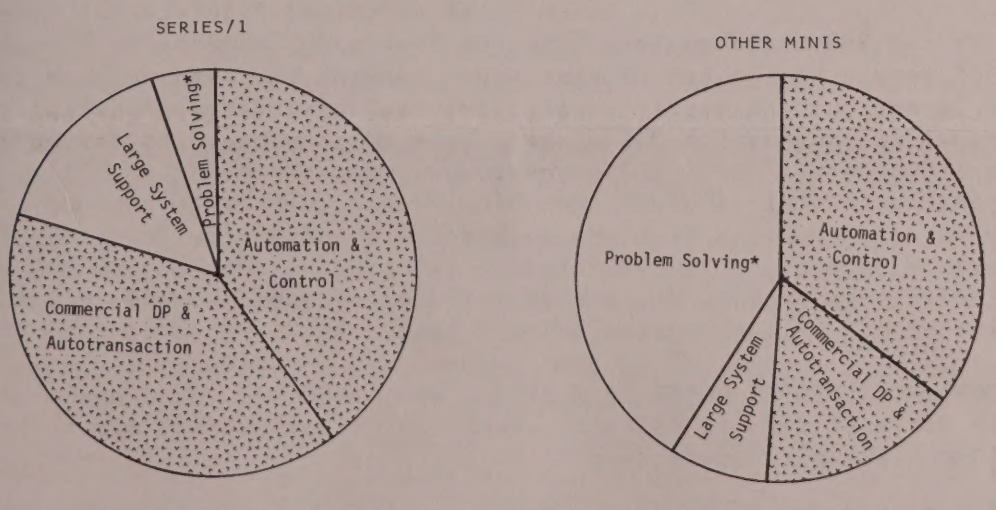
	Total Revenue $M	Service & Software	Shipment $M	Average System $K	# Systems Shipped	Installed Value $M
1976	2	-	2	-	50	-
1977	30	2	28	25	1,150	30
%Δ	167%		150%		143%	233%
1978	80	10	70	25	2,800	100
%Δ	150%	150%	145%		161%	175%
1979	200	25	175	24	7,300	275
%Δ	100%	180%	89%		96%	120%

As a result of the Series/1's renewed vigor, says IDC, by 1983 IBM will be shipping some 50,000 systems a year and garnering nearly $1.4 billion a year.

Not much of this, however, will come at minimakers' expense. By 1983 IBM will have only 11% of the market -- nowhere near its usual penetration -- and will have expanded it $1.1 billion. In other words, about 80% of IBM's mini business will not overlap with the traditional business (the IBM nameplate has that power!) . . . and the Series/1 might actually impinge on IBM's own base more, say on the 8100.

When it comes to using the Series/1, says the IDC report, buyers are putting the minis into automation and control -- especially power and energy management -- and commercial DP and autotransaction. The power and energy management systems would follow from IBM's first software system for the Series/1 -- power and energy management -- and the success in this area of IBM's only other mini, the System/7. Commercial DP and autotransaction speak to the number of software houses adding business packages to the system.

APPLICATIONS MIX FOR THE SERIES/1 VERSUS TRADITIONAL MINIS



*MINI SOLD AS TOOL

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• IBM WON'T SHIP THE SYSTEM/38 ON TIME, in fact it will be 6-9 months late. The reason is software testing, and in an upcoming issue of EDP/IR we'll explain why this is not so unreasonable. Hint: System/38's operating system was designed from the bottom up. It's totally new.

• ASTUTE READERS WILL HAVE CAUGHT THE TYPO IN OUR REVIEW & FORECAST ISSUE: as the inside numbers show, computer shipments will increase 18% this year.

• THE NON-PCM MAINFRAMERS HAVE LOGGED SOME IMPRESSIVE FIRST QUARTERS . . . all of them except IBM showing margin increases over second quarter 1978. In order of decreasing earnings/revenue; 1) IBM posted 2Q earnings of $667 million on revenues of $5,355 million -- a 12.5% margin versus 1978 2Q's 14.0%; 2) Burroughs posted 2Q earnings of $68.9 million on revenues of $688.5 million -- a 10% margin versus last year's 9.6%; 3) NCR's earnings were $58.9 million on revenues of $717.6 million, a margin jump from 6.4% to 8.2%; 4) Honeywell's 2Q earnings/revenue margin went from 5.1% to 6.2%, earnings were $61.3 million on revenues of $991 million; 5) Sperry Corporation (Univac not broken out) had 2Q (Sperry's 1Q) earnings of $54.2 million, revenues of $1,090.2 million, boosting a 4.6% margin to 5.0%, and 6) Control Data's 2Q net earnings were $37.6 million on revenues of $772 million (counting Commercial Credit) -- or 4.8% of revenues, versus last year's 3.8%. Good show.

• INFORMATICS ANNOUNCES MAJOR ENHANCEMENTS TO MARK IV, its application development system. The new release will add new graphics capability, on-line support, and multi-dimensional arrays. Major architectural changes, says the company, should increase throughput of the system considerably.

• TELETYPE IS TARGETING END USERS, according to reports EDP/IR picked up at NCC. It has set up a special end user sales force and is coming out with products oriented to specific applications. Teletype raised the product planning function to executive vice president status, and is defining new members of the 4500 family . . . so expect announcements in the next several months, particularly in the I/O area. Indication of a future trend; the 4520 has ROM and RAM and is user programmable.

In addition, Teletype has added 6 field offices and 150 field engineers in the last year, expects to have 90 offices and 600 people by the end of next year. Demand has been so good that the company is now quoting a year's wait for the 4540 and the 43, despite a planned production increase of 30% a year. The company has also formed a custom systems division . . . 75%-80% of customers want something special. Teletype is expanding, and its inhouse technologies are relatively awesome. Currently it buys no components from cousin Western Electric (but that may change when WE's bubble technology is perfected). Teletype has one custom MOS semiconductor facility in Skokie, IL, and is building a second to add to its current capacity of 1.6 million custom chips a year.

• SEMICONDUCTOR MEMORY UNDER 1¢ A BYTE? Yes. DEC has just announced a memory price decrease for its LSI-11/2 where the effective 64KB memory price is $582 in OEM (100 unit) quantities.

• LEAR SIEGLER TAKES A FROZEN TOE OUT OF THE SMALL BUSINESS SYSTEM WATERS . . . backing out of a year-old commitment to making such systems.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" AUGUST 16, 1979 • VOL.15,NO.6 P.J.McGOVERN,PUBLISHER

Warm feelings for E Series

USED COMPUTER DEALERS MAKE OUT ON 4300 DELIVERY DATES AS THIRD-PARTY MARKET PASSES $3 BILLION

While many areas of the EDP industry are suffering as a result of IBM's introduction of the 4300 (EDP/IR,Aug.6,1979), at least one is booming as a result . . . the sale of used computers.

After a temporary winter dip as users got their bearings on the 4300, sales began to creep up for machines to fill the breach. Further, volume shipments of the 303Xs are spurring the third-party business in those units and in the units they bump. As Bill Grinker of the Computer Dealers Association (CDA) says, "ours business is all a function of available supply. Whenever our supply increases, business increases."

The only mixed blessings: users waiting for H Series are renting more units from IBM than anticipated, and late delivery dates have affected third-party companies planning to resell 4300s. Still, the overall volume of IBM computer shipments helps to offset these problems.

Harry E. Goetzmann, Jr., President of Continental Information Systems (CIS), a major used computer dealer, puts it this way: "The more announcements IBM comes out with, the more business we do." Since dealers and brokers -- as opposed to lessors -- move equipment relatively fast and keep inventories as low as possible, dropping residual values affect them only as they affect the supply and demand. Some notes on that supply and demand (U.S. only):

- By dollar or by unit, about three-quarters of IBM 370/303Xs are purchased or under third-party lease; about 45% are purchased.
- 158/168 class IBM machines had the highest purchase percentage as of 12/78; 138s, 148s, and 303Xs had the highest IBM rent/lease cut.
- The demand for 4300 interim machines has driven up the price of 138s and 148s; the 158, 168 market has stabilized somewhat (the IBM price hike helped that) although supply is still a little tight.
- The recent 303X rental price hike has had little effect . . . it's apparently not enough to push renters into the third-party mart.

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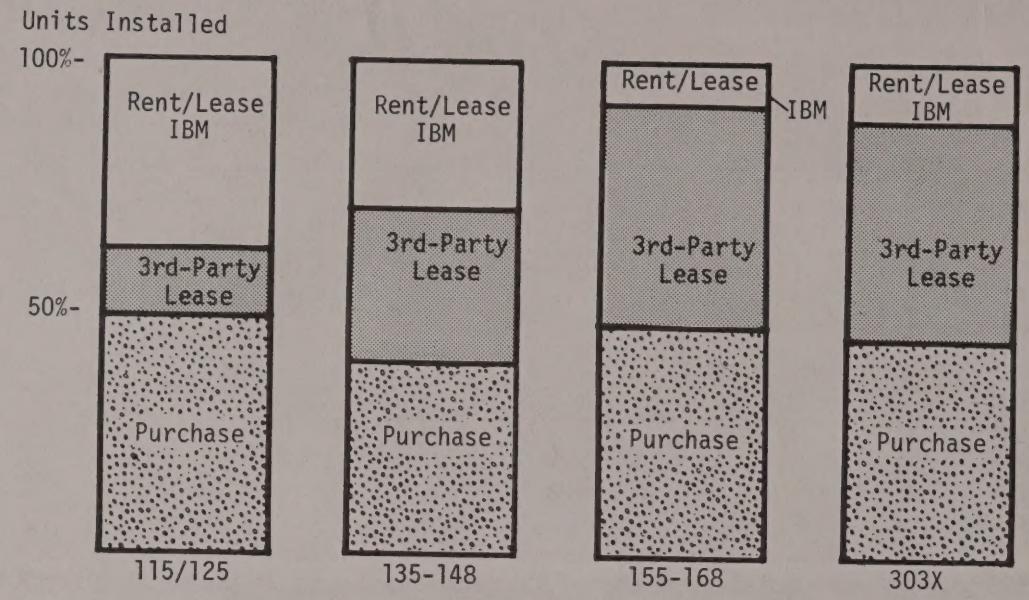
THE RENT/LEASE/PURCHASE OF IBM CPUs -- 12/78



The announcement of the 4300 and the anticipation of the H Series has skewed the high-end systems toward higher rental than expected.

The market as IBM blesses it

The third-party market for computers began with the 1956 Consent Decree in which IBM promised to sell as well as rent computers and to treat all customers equally with respect to software and services. IBM's blessing on the used computer market has been extended in other ways:

- IBM offers support and maintenance on "previously-owned systems; not all mainframers do.
- The IBM policy on purchase option credits for rentals has spurred the market (there are cases where residual value is higher than purchase price under the purchase credit option).
- IBM doesn't actively market its own used computers.

Indeed, the used market is an IBM world, primarily because of its massive base and its relatively benign attitude toward it. The Computer Dealers Association contends that over 95% of the dollar volume of its members involve IBM equipment; more conservative estimates still see it above 90%.

While IDC pegs the 1978 revenues for third-party suppliers at $3 billion, that includes money from third-party leases on new IBM gear. The dealer and broker subset -- brokers get buyers and sellers together, dealers actually maintain an inventory -- is elusive. But the CDA says that from $50 million in 1970, sales of used equipment topped $2.5 billion in 1978.

And while in 1978 the top three suppliers, Comdisco, Computer Marketers Inc., and CIS -- all dealers -- pulled in $300 million, the market is fragmented. IDC estimates there are over 200 brokers and 20 dealers in the business. Many now with warm feelings for the 4300.

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IBM'S GSD FALLS NINE MONTHS BEHIND ON SYSTEM/38 DELIVERY
COMPLICATED OPERATING SYSTEM APPEARS TO BE THE PROBLEM

> *"When IBM introduces new hardware for old software, I am confident; when it introduces new software for old hardware, I don't worry too much. But when it introduces both new hardware and software in a product, I hedge my bets."* --overheard from a seasoned DP manager

When EDP/IR last fall mused that System/38 bore the "earmarks of rush" (EDP/IR,Oct.30,1978) . . . little did we realize the extent to which it was true. IBM's General Systems Division says the S/38, due for first customer shipment this month, won't be ready until mid-1980.

IBM would only state that additional time would be necessary to integrate and test the systems programming elements . . . which translates to troubles with the operating system. Trade press reports indicate that it is the very complexity of the operating system causing performance degradation . . . the S/38 is spending too much time running itself.

It's almost understandable. When GSD announced the system, it trumpeted new hardware -- 18K and 64K chips -- and radical new software, development of which is always costly and time-consuming. The S/38 would provide:

- Two levels of microcode
- A high level machine instruction set
- A new control language and data definition interfaces
- A 281-trillion address space for virtual memory

Building from the ground up

One of the reasons GSD felt it could pull off the S/38's software development was because the system was designed from the ground up . . . with new concepts which include "a layered structure providing consistent interfaces, a unique high-level machine architecture, and powerful capabilities for virtual addressing and task management." Says an IBM technical publication:

> *"A total-system approach was used for the architecture, design, and implementation of System/38. That is, system-wide design trade-offs were made during the design and implementation of all components. This way to eliminate potential problems of design mismatch was supported by imposing no internal compatibility constraints with previous systems. Almost all design and implementation was done in the same location by the same organizational entity."*

Normally to provide advanced function like that available to the S/38, designers have come up with discrete subsystems -- such as data base support -- each having different user interfaces, specific configuration parameters, and separate installation or service characteristics. This was partly because of the lack of system-oriented design and implementation . . . and the lack of well-defined architectural structures. The S/38 addresses those lackings.

Layered architecture

If an architecture for a computing system is "layered," it means that various conduits for data or instructions between functions are formally

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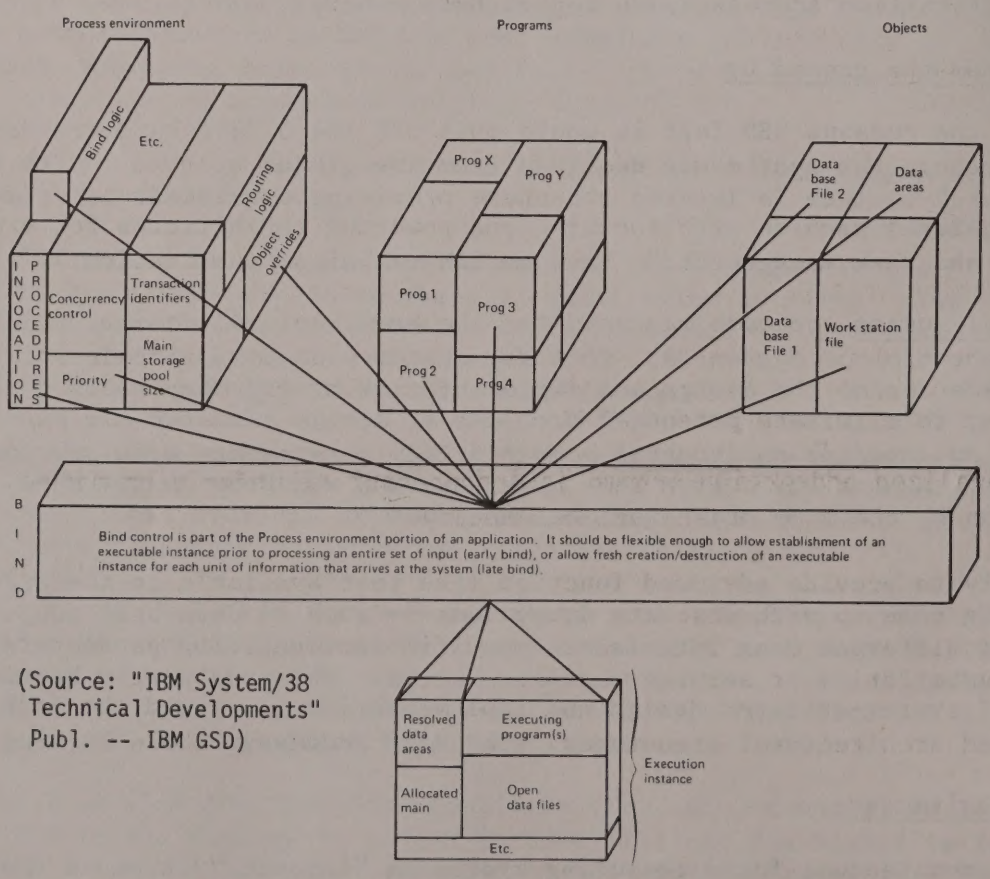
defined. Thus, changes to one layer can be effected without necessitating changes to another. Layering makes sense for computer makers . . . since it means they can upgrade their systems without extensive software rewrites. In the System/38, layering is carried to an extraordinary degree . . . there are two layers of microcode that implement the machine instruction set.

Designing the user interface

A number of technical concepts in the System/38 influenced the way IBM decided to let users access the system . . . these include program/data independence, program/system independence, "binding" flexibility, transaction processing, and modular applications structure. In turn, IBM sees these concepts dependent on the basic notion that applications (and even systems) consist of three major entities:

- Objects -- the pieces of an application that "get worked on," typically data base files and/or devices.
- Programs -- those parts of the application that "work on" the objects. A program may also be an object at a different time.
- Processing environment -- the conditions under which an application will run (which programs will process which objects when). Many aspects of the environment are system dependent.

A METHOD OF COMBINING OBJECTS, PROGRAMS, AND ENVIRONMENTS



(Source: "IBM System/38 Technical Developments" Publ. -- IBM GSD)

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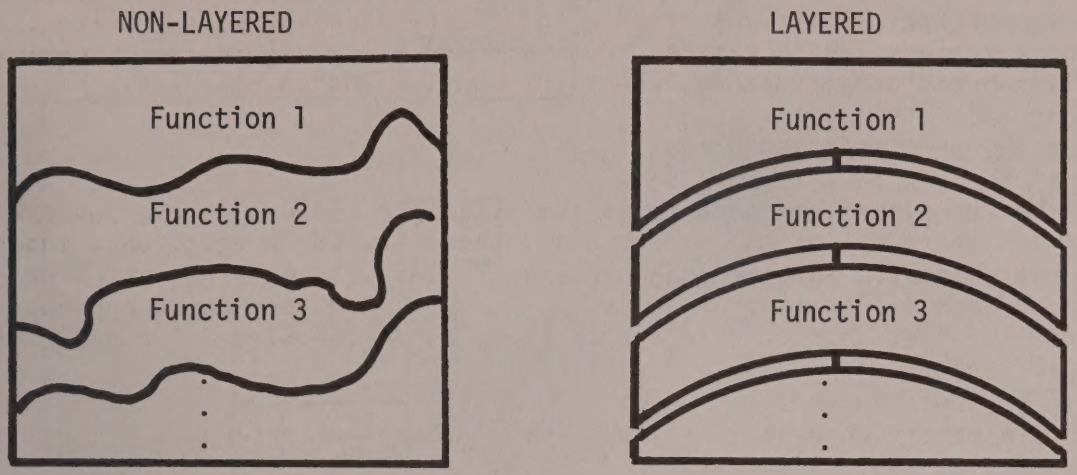
THE IDEA OF LAYERED ARCHITECTURE



In both layered and non-layered architectures, a certain number of functions are performed by the system . . . data base control, work station support, etc. In non-layered systems, these functions are carried out by hardware or software in no formalized fashion; and changing the code for one function often affects code for others. At the least, numerous "system generations" or tuning procedures are necessary to adapt the programming to different machine configurations.

Not so in a layered system. Here, because the interfaces between functions are formalized, change to one doesn't affect the others. The trade off, of course, is that layered architectures are harder to design and may take more resources to implement (case in point: SNA).

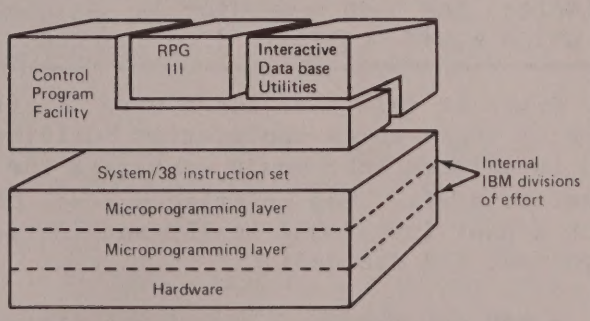
THE IDEA OF A HIGH-LEVEL MACHINE ARCHITECTURE

Just as program products have been layered to improve consistency, so has the machine instruction set in the System/38 . . . with an advanced high-level machine instruction interface. This has been accomplished by:

- Absorbing hardware dependencies into internal microcode, and
- Eliminating data format dependencies by system design and a unique memory management system

The generalized addressing scheme is independent of underlying machine characteristics (I/O mechanisms, data format, hardware registers) . . . which extends high-level language interfaces to lower levels of programming. I.e., changes to microprogramming don't affect IBM or user programs.

There are, in fact, two separate layers of microcode. One resides in control store and handles systems tasks, the other sits in main memory and provides the hardware independence for user programs.



(Source: Ibid.)

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HOW TO STUFF 281 TRILLION BYTES INTO A SYSTEM/38

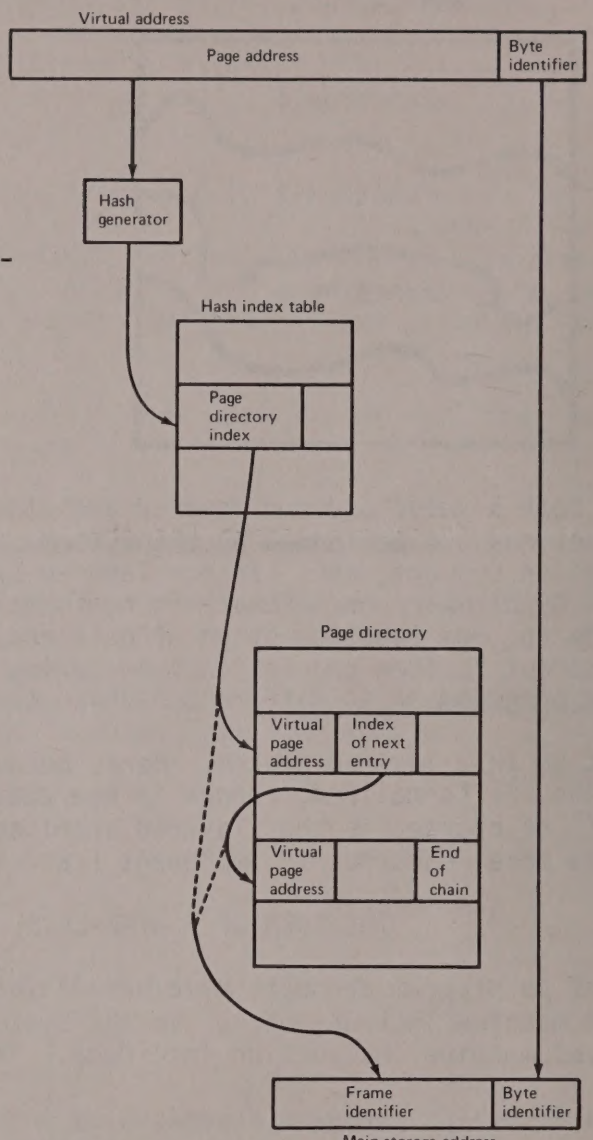
The S/38 supports a 48-bit virtual address space -- which yields 281 trillion bytes. Main memory can support only a minute fraction of that at any one time; and because the virtual address is so large, conventional VS techniques won't work.

What IBM has said will work is a double-indexing scheme.

The virtual address space is divided into 512-byte pages -- a frame of main memory when it is in main memory at all, A virtual address is made up of a page identifier and a specific byte identifier.

Specific bits from the virtual address are combined -- or "hashed" -- by a "hash generator" to select an entry from the hash index table, which in turn contains an index into the page directory. A part of the page directory is reserved as a pointer to indicate where additional entries with the same hash are to be found.

During the translation of a virtual address, the page directory search mechanism need only find the chain that contains the virtual page and search the entries on that chain. If a match is found, then the index of that page directory entry is the frame identifier for the virtual page. If an end-of-chain bit is encountered before a match, the system brings the page corresponding to that virtual address from secondary storage to main storage and updates the page directory.



(Source: Ibid.)

(Note: the hash generator is designed to prevent long page chain lengths -- which would result in long searches and degraded machine performance.)

Since it felt that there were benefits resulting from the clean separation of these three application building blocks, IBM tried to design languages and interfaces that would encourage the user to consciously delineate the separate parts. The interfaces also, however, would have to accomodate users with a past investment in IBM machinery. Considering the trade-offs involved, IBM decided:

- RPG was the best base for building a program definition interface -- user investment in it is high. It was enhanced to RPG III.

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- Because of the new system functions to be offered, a new method was necessary to control and manipulate the processing environment. A new control language was designed.

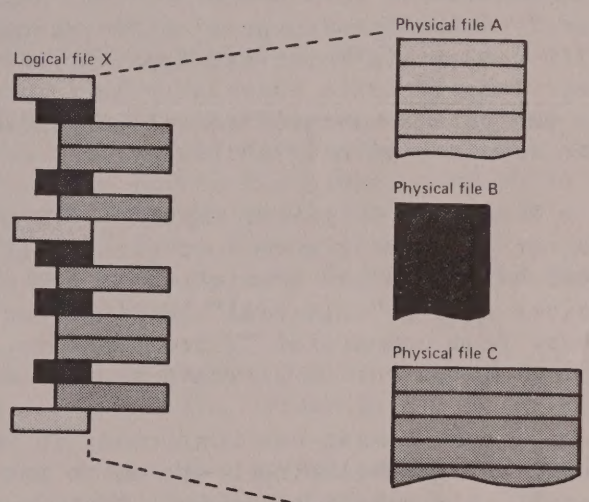
- The object definition interface could have been folded into RPG or the control language; RPG was rejected because too many objects were system dependent, and IBM would be limited to offering RPG as a programming language.

The S/38 data base

According to IBM, the System/38 is "the first computer system to have a full-function data base facility designed as a part of the basic machine." All on-line data is stored, and handled through the data base component.

Two types of files on the S/38 are 1) Logical Files and 2) Physical Files. The latter represent the actual stored locations of data; the former provide alternate user views of the stored data to support application and data independence (and avoid redundancy of data).

A physical file has one access path and one format . . . i.e., all records within members of that file have the same fields, attributes, and length. A logical file has one access path but one or more formats, depending on which fields or in what order the user wants to see the file's contents. Users (applications) deal only with logical files.



(Source: Ibid.)

Where's the hold up?

According to reports in Computerworld from inside sources, the complexity of the operating system causes it to thrash -- it spends too much time looking for system software, not enough actually processing "objects."

For instance, the Job Control Language table of contents has 247 separate commands . . . each with from two to many parameters. "This means that a large number of character strings have to be analysed and then the verb character string and parameter character string have to be parsed in order to find the correct operating system module to bring into the processor," says the article. "In order to find that module, the system has to go down a large number of trees, and this consumes a huge amount of CPU time."

In other words, the problem is cramming a sophisticated operating system and a scheme for keeping track of 281 trillion bytes of virtual storage in a small System/38.

So, for the first time in memory IBM will be late shipping a product, and a lot of programmers will have to work overtime. But in the end the users could win out . . . for they finally get a system designed from the ground up with them in mind, not IBM's investment in past software.

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• WHEN MA BELL SAYS IT'S GOING TO DO INDUSTRY MARKETING . . . for the first time AT&T will exhibit at the Association of Iron and Steel Convention, displayine Dataspeed, Comm-Stors, et al, in different manufacturing jobs.

• THE DEPARTMENT OF JUSTICE HAS ANSWERED FOR JUDGE EDELSTEIN and told IBM and the court that IBM's request for Judge Edelstein to step down from the case (EDP/IR, Aug.6,1979) was out of line. First, said the DOJ, IBM shouldn't have let the case progress through 4 years of pretrial discovery and 3 years of trial if it did have a beef, second IBM's argument was speciaous anyway.

• YOU CAN NOW HOOK YOUR 3270s TO A PUBLIC PACKET NET, says Tymnet. "It may be," says the company, "the most significant advance in the market for public packed network services since the original availability of such services." Using Tymnet, previously-incompatible ASCII terminals can now access 3270-compatible hosts and applications in a "virtual terminal" mode. This, says Tymnet, could especially help in connections to service bureaus. Savings in the yet-to-be-tariffed service will come at the terminal end, where users can reduce terminal redundancy.

• PROMISING TO INVADE THE SANCTITY OF THE LIVING ROOM, National Semiconductor and Comsat have some plans that will affect home TVs. First, National Semi has announced a unique chip set that can transform the standard TV receiver into a "universal" terminal for the reception of signals other than those from commercial TV broadcasters. This should be especially helpful for all those potential Viewdata vendors out there.

Second, Comsat has confirmed, in response to queries, that it is considering developing a system to provide subscription TV service by satellite directly to homes. Small antennas (presumably under 1 meter) would be used; subscribers would pay less than what it costs to take a family to the movies once a month. The new service could be here as early as 1983.

• IT LOOKS LIKE A CLASSIC CASE OF GOVERNMENT VERSUS BUSINESS . . . in the growing battle between the Federal Trade Commission and the American National Standards Institute (ANSI). The FTC proposed a rule last December that would seek to regulate, for the first time, all organizations and groups which engage in standards development or certifications (all industries, not just EDP). ANSI, a private organization, opposes such government regulation over its lifeblood business. EDP/IR readers are advised: while it sometimes seems a task nonessential to workaday life, the setting of standards for the industry is of great importance. Especially in one as fast-changing as ours. It behooves all interested parties to seek input to the controversy . . . and all uninterested parties to ascertain whether or not they should be interested.

• DIGITAL EQUIPMENT JACKS UP MEMORY FOR ITS MAINFRAMES, announcing both the availability of MOS memory for its DECsystem-10 and expanding capacity for its DECsystem-20 . . . the three systems based on the KL10-E CPU. Up to 12 MB may now be installed on the 1091-S, and the 2040 and 2060.

• A $5,000 FIRST PRIZE will go to the winner of a competition by the Society for Management Information Systems (SMIS) for individuals describing significant contribution to the development and effective use of MIS. Nice.

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"THE GRAY SHEET" SEPTEMBER 10, 1979 • VOL.15,NO.7 P.J.McGOVERN,PUBLISHER

Gestation period over?

THE FIBER OPTICS INDUSTRY REACHES INFANCY AS SUPPLIERS SEARCH FOR NICHES IN TOMORROW'S $4.5 BILLION MART

As little as five years ago communications via glass fibers was a laboratory oddity . . . an "iffy" technology that might or might not pan out in competition with such other media as satellites and millimeter wave guides.

But now millimeter wave guides are still "iffy," satellite communications have evolved into a complimentary technique, and optical fibers are carrying voice and data traffic in scores of installations across the globe. And while the market for optical fibers, cables, connectors, and electronics is still infinitesimal by computer industry standards . . . over the next decade it will bring suppliers over $4.5 billion and may, in fact, have a greater impact on the way we communicate than the market numbers would indicate.

That the fiber optics industry is beyond the gestation period -- past the "blue sky" stage -- is not mere conjecture. Some of the evidence:

- AT&T has endorsed it. With performance specs on its experimental installation in Chicago above normal, Ma Bell has launched a program for systematic installation of fiber optics carrier systems.

- Supplier ranks read like a "who's who" of electronics: AT&T, Siemens, IBM, Hewlett-Packard, RCA, GTE, ITT, Harris, Northern Telecom, Fujitsu, Nippon Electric, and scores of smaller companies.

- Production volumes are allowing costs to drop for cabling/fibers, breaking the "chicken-and-the-egg" stasis (lower costs spur volume orders, but only volume production allows lower costs).

- Breakthroughs in fiber-drawing and laser/light emitting diode development ensure the continued increase in price performance of fiber optics. Already fiber optics beat out copper and coaxial cable in some applications.

So there is an industry abrewing out there, even if its revenues won't hit $100 million until 1982 . . . but remember the minicomputer industry, which didn't hit the $100 million mark until 1966. Now look!

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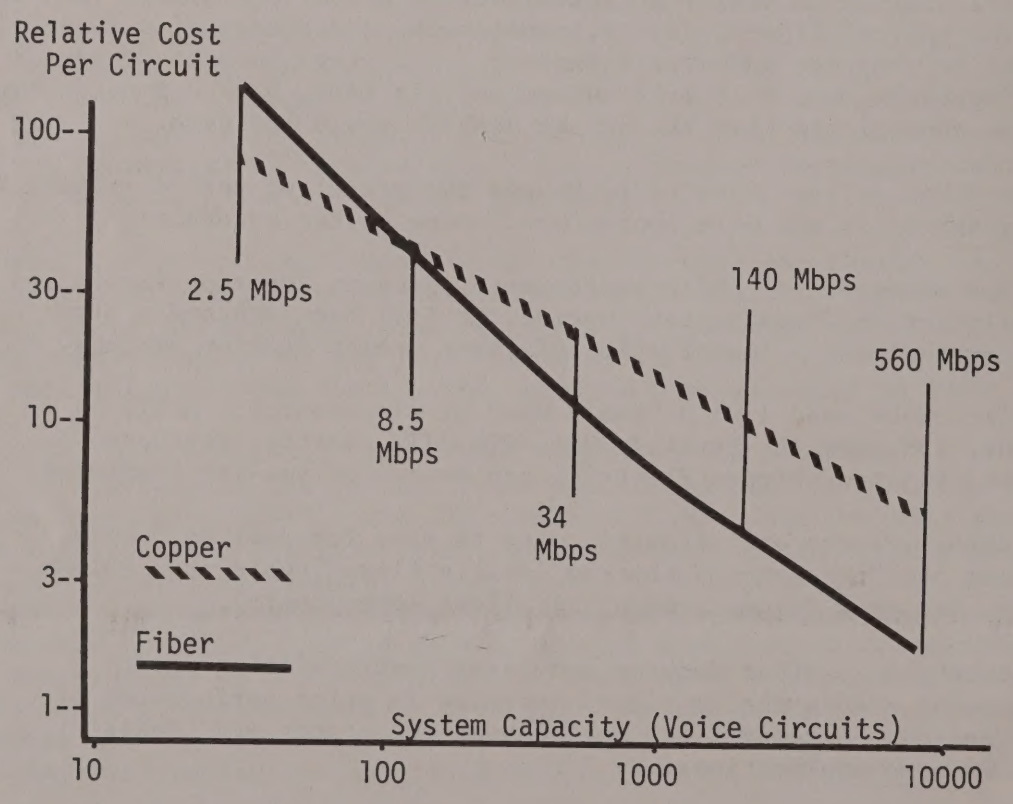
Why fiber optics?

As EDP/IR mentioned when we last looked at fiber optics (EDP/IR:Aug.9, 1976), the gossamer strands have properties especially amenable to data communications. These include:

- Wide bandwidth, which translates to high bit rates
- Immunity to electrical interference
- Benignity to digital transmission
- High security possibilities

The problem, of course, has been cost performance. But now Corning and others can draw fibers clear enough to require signal regenerators only once every 5 miles or so -- if water were this clear, ocean bottoms would be visible -- and are taking orders for fiber at 10¢ a meter. Fiber optic systems are already encroaching on coaxial cable domains; will eventually begin to compete with copper cable. Especially if copper prices rise. Just this summer Belden, Hewlett-Packard, and Valtec, three major suppliers, have cut prices 20%-70%. Corning's subsidiary, Siecor, dropped prices last March.

CAPACITY OF FIBER OPTICS VERSUS COPPER CABLE



Note: Based on a route of 50-100 km, no multiplexing. At about 10 Mbps, it is seen that optical fibers offer economic advantages over copper ..... Source: T.G. Giallorenzi, IEEE Proceedings, 1978, from K.C. Kao and M.E. Collier.

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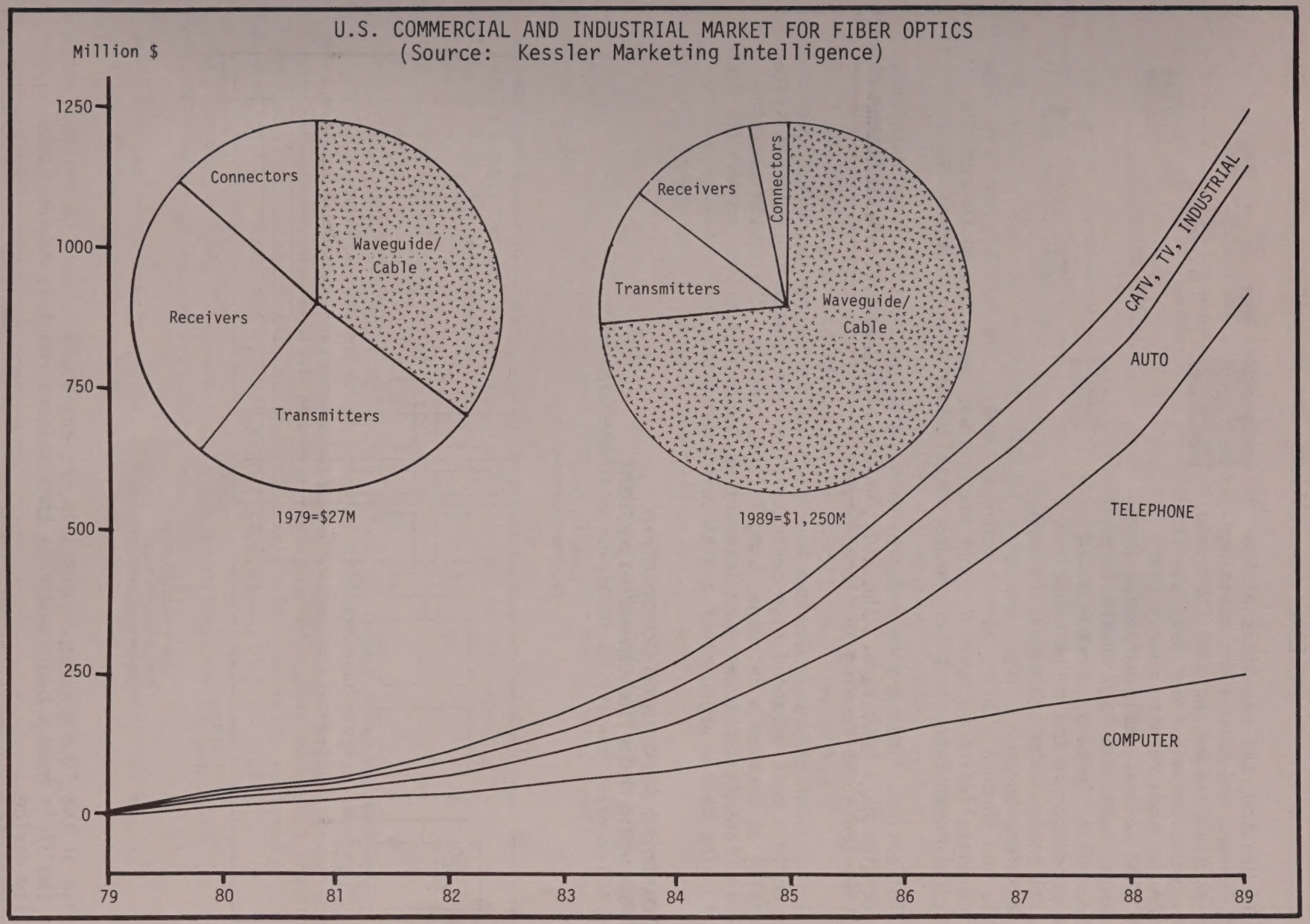

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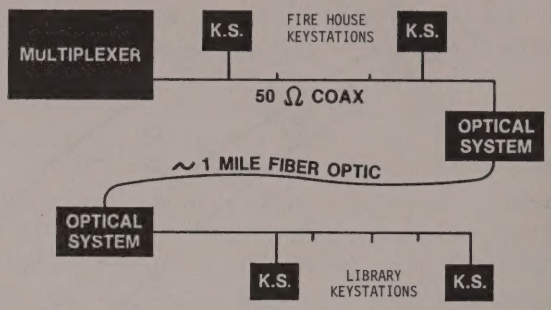
TWO EARLY APPLICATIONS IN COMPUTERS



In Houston, CRT operators at the city library and fire alarm buildings gain access to a Univac 1900 CADE data entry processor via fiber optics. The system has been running over a year, with 3200 feet of cable extending from 5 library terminals to 4 in the fire house, which, in turn, are connected to a processor in the court house via coaxial cable. The cable runs through 13 manholes, under a bridge over a bayou, and through a 30ft. tunnel under a subway. The cable broke only once during installation because of kinks when it was being snaked through the ducts. A month later it broke during installation of an adjacent cable.

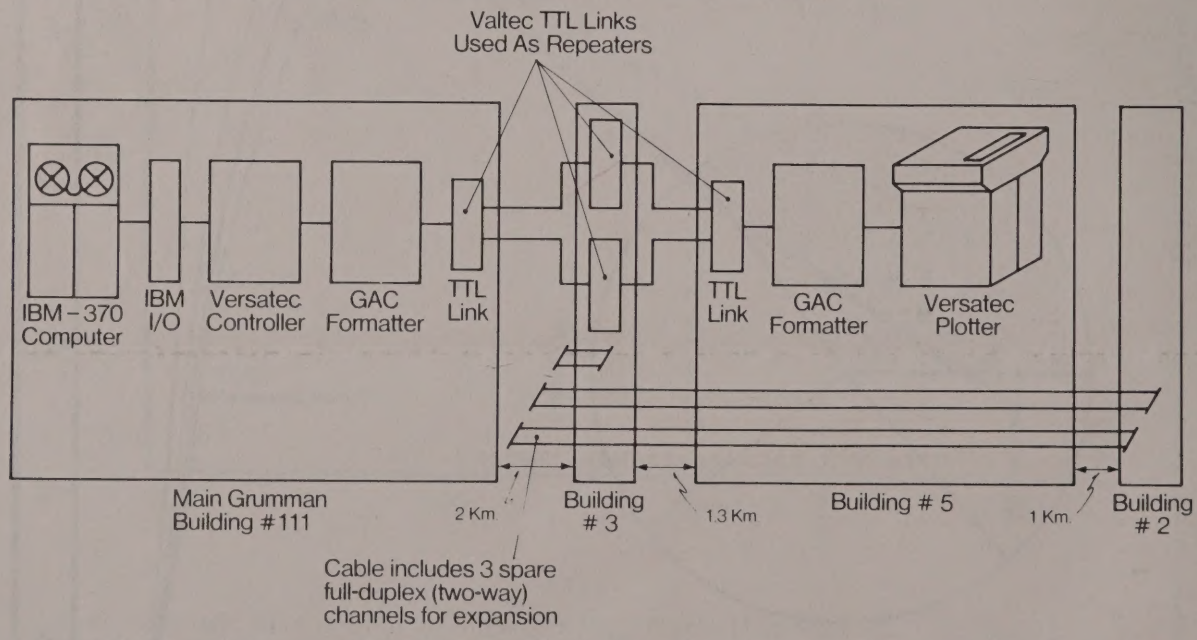
The optical links are half-duplex with receiver/transmitter at both ends for sending data both ways. The link doesn't use modems -- the CRTs appear to the CADE CPU to be running in "local" mode.

* * * * *

In April of this year Grumman Aerospace and Valtec cut over what they call "the world's most advanced high-capacity fiber optic data transmission system." Operating at Grumman's Bethpage, Long Island, complex, the system provides two-way transmission between an interactive Xerox plotter and an IBM 370 3 km apart. The system uses one of 4 available channels.

Grumman Aerospace Corporation
Fiberoptic Data Transmission System

Jointly Produced and Systems Integrated by Grumman and the Valtec Corporation



Use of the fibers makes it possible for engineers to call up prints from the 370's memory banks and have them printed remotely on the high-quality device.

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A market with fuzzy outlines

With less than 100 systems installed between 1975 and 1978 in the U.S., the market for fiber optics systems is yet indistinct. Most components and systems still go for experimentation and prototypes. But the market is growing . . . and at a rate faster than most observers predicted a few years ago.

Market forecasts proliferate -- even though AT&T's actions alone could skew predictions way off. Most forecasts show North American shipments less than $100 million today; and predict $1 billion in shipments coming sometime between 1985 and 1990. One of the most reasoned approaches to estimating the market -- at least to EDP/IR -- is that of Kessler Marketing Intelligence, where baseline markets are examined for fiber optic penetration. Industry by industry, according to Kessler:

- Data links for computer systems -- both in the computer room and between CPUs and peripherals -- will form the majority market for fiber optics until 1984. Almost all major computer vendors are working with fiber optics.

- In 1984, though, the telephone industry will take over as the largest single market for fiber optic systems and by 1989 account for 3/4 of the total market.

- The automotive market, destined to open up about 1981, will be a third major submarket, with illumination applications (high loss fiber) outstripping signal transmission until 1984.

- CATV, and to a lesser extent, broadcast TV, will be another big submarket (many of the early installations of fiber optics are in CATV applications), limited by problems in local distribution of head-end signals.

- Industrial usage -- e.g., in nuclear plants and in oil-logging operations -- where fiber dielectric properties are important will be a steady, but lesser market.

And the promise . . . less fuzzy?

Scenarios abound with fiber optic systems in the 1980s ferrying wideband data signals to and fro in high speed computer-computer hookups, two-way CATV systems, between homes and fire houses or police stations, in teleconferencing applications, and so on. And, in the long term they will come about . . . as will more reliable laser light sources, cheaper gallium arsenide semiconductors, and computers that use optical rather than electrical switching.

But, for the record, there are some short term barriers to the rapid growth the technology itself must deserve:

- Manufacturing volumes are still not high enough to power down costs, although captive markets (IBM, AT&T, H-P, NCR, DEC, etc.) help.

- The status quo is entrenched . . . with long telephone industry depreciation cycles, designer conservatism, manufacturing hegemonies in cable, switches, etc.

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- The infrastructure needed to utilize the incredible bandwidth fiber optics systems allow is not there . . . the communications environment grew up around twisted copper wire-pairs. Fiber optics will first have to interface with equipment designed for slower-speed, narrower-band communications.

- Standards -- de factor or de jure -- are not yet established.

But ignore fiber optics at your own peril. It is a communications medium remarkably suited for digital transmission; and tomorrow will be a digital world. In the 1980s, fiber optics will take its place in the communications hierarchy along with coaxial cable, wire-pairs, microwave and satellite. In the decade after that it may rise to the top of the hierarchy . . . and, as it does, drastically change the way we apply communications.

COMMUNICATIONS ACT REWRITE SOURS FURTHER AS DATACOMM CONTINUES TO THRIVE
INDEPENDENTS TO OUTSHIP AT&T IN A 1979 MARKET OVER $750 MILLION

Against a backdrop of booming sales in modems, multiplexers, and communications processors -- lumped under the catch-all as datacomm equipment -- the Solons of Congress continue their tragicomic attempt to rewrite the communications law of the land. When last we left our beleaguered players (EDP/IR, July 18,1979) they had thrown up their hands at writing a new script . . . and had decided to revise the old one instead.

Translated, that means that the Van Deerlin (D-CA) attempt to rewrite the Communications Act of 1934 had metamorphosed into a lesser penciling of the Act, a revision. Now even that is in jeopardy.

For new conroversy has been spawned by an AT&T revision of an FCC staff working document on HR 3333, the bill Van Deerlin was to propose. The Bell revisions would lessen its antitrust immunity in unregulated -- or deregulated -- markets and skirt the 1956 Consent Decree. The revisions are controversial enough, and even more steam was raised by the method Bell used to obtain the working draft and submit its revisions.

As a result, it's likely that no new communications law will be penned this year . . . convtroversy is sure to stall the writers, election politics sure to stall the legislators.

The datacomm market booms

If the overall forest of communications is clouded in uncertainty, to the trees in the forest it seems like good weather indeed. A recent report by IDC gives the following reading on the datacomm equipment market:

- Today's U.S. base of $3 billion installed modems, multiplexers, and communications processors will reach almost $8 billion by 1983 -- a compound growth rate of approximately 21%.

- 1978's shipments of $640 million worth of gear will swell past the $1 billion mark in 1980 and reach $1 3/4 billion by 1983.

- Areas that will show better-than-average growth: short-haul modems, 1200/2400/9600 bps modems, stat muxes, and remote concentrators.

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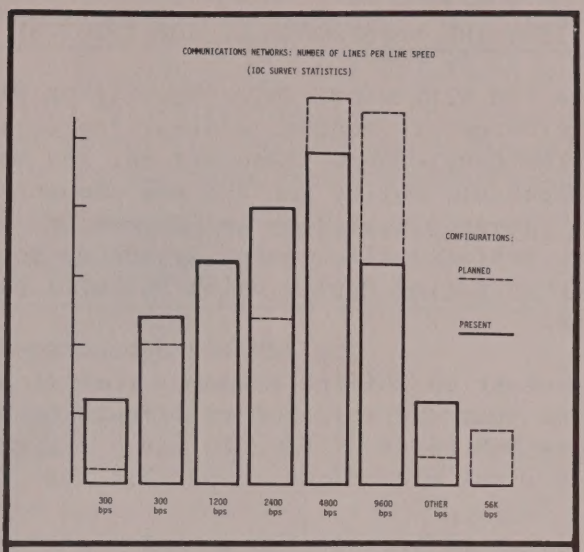
And, that's not necessarily surprising. In another recent IDC survey of user network configurations, the sample reported the most popular line speed was 4,800 bps, with 2,400 bps second in rank (popular = number of lines). But planned configurations would leave the 9,600 bps line speed second in popularity only to 4,800 bps. And enough 56K bps lines would be installed to break out of the "other" category.



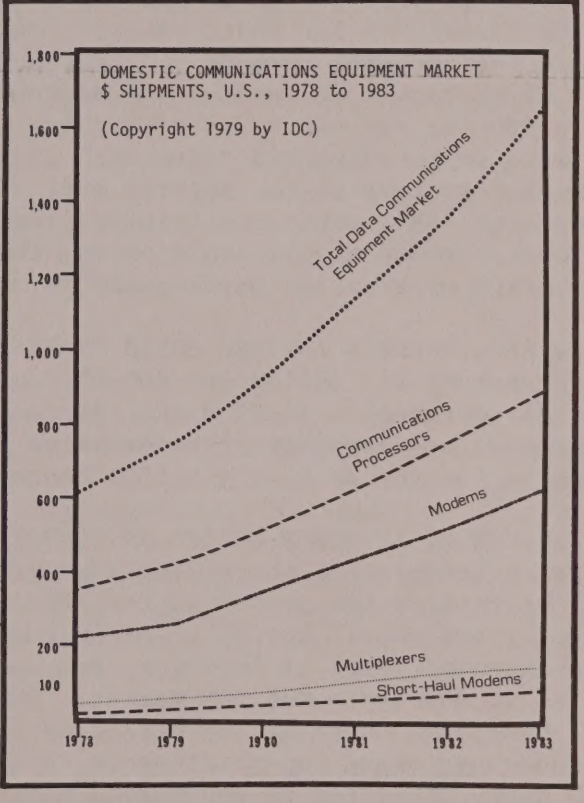
Communications processors

By far the largest line item by value in the datacomm equipment market, communications processors (front-ends, mostly) will nearly triple in installed value from $1.36 billion to $3.88 billion in 1983.

IBM dominates this submarket with its hard-wired 270Xs and programmable 370Xs . . . accounting for 55% of the units installed, 50% of the dollar value. Memorex, Comten, CCI, and others follow in ranking in that order.

Multiplexers and modems

The multiplexer market, in which AT&T holds about 20% of the market with its frequency divison multiplexers, will more than double in installed base in the next 5 years from about $375 million. Statistical multiplexers -- which can accomodate more low-speed input ports than the high-speed output port can support -- will do especially well, quintupling to form 80% of the installed base by 1983.



Major multiplexer vendors, besides leader AT&T, are Timeplex, Codex, Infotron, Western Union, and General Datacomm.

In modems the 9,600 bps units show the most promising growth; and by 1983 they'll have the largest dollar value of shipments of any modem subgroup ($150 million). Short-haul modems, used in limited distance networks, will show a dramatic 40% growth rate over the next 5 years -- at which time about 600,000 units will be in place. Major modem vendors: Racal (Milgo/Vadic), General Datacomm, Codex, Rixon, UDS, Intertel, Paradyne, and Anderson Jacobson. Not to mention AT&T, which holds 25% of the dollar market.

In other words, the datacomm equipment market is growing healthily. . . in spite of the legislature's efforts to help it.

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• IBM WILL WALTZ INTO DISCOVISION WITH MCA, agreeing with the California distributor of records, movies, tapes, and video disks to form a joint venture for the development, manufacture, and marketing of video disks. In an SBStype arrangement, policy for the new company will be set by an "Associates Committee," jointly headed by an IBM senior vice president and current president of MCA. Profits will eventually accrue to each partner equally, with an initial start-up period during which MCA will garner more than the Armonk computer maker.

The IBM/MCA announcement follows by several months an announcement by Philips Magnavox that it has built a prototype optical disk recorder that can store 20 trillion bits on a dual-sided disk. At the projected future OEM costs of $10,000 for a player and $150 a disk, the Magnavox system would rival microfiche in per-bit cost.

So, will IBM use its new system as an adjunct to its computer room equipment? EDP/IR thinks not. IBM wouldn't need MCA for that. No, it looks like IBM is taking a first step toward the consumer market . . . although the subsidiary, dubbed DiscoVision will first tackle industrial and educational markets. Scenarios could have IBM producing its own video disk player and distributing via MCA, or sending software or training via video disk to users of its small business/home information systems of the future, etc. In the meantime, don't expect radical changes in IBM's strategic thinking (remember how cautious IBM was with the Series/1 introduction); don't expect the Giant to divert funds from E series production or H series development to develop video disk programs.

• HEY, THERE'S ANOTHER SOLID STATE DISK OUT THERE -- this one from Cambridge Memories. Called the CMI-05 SemiDisk, it's a direct replacement for Digital Equipment's RK-05 Disk. It features nanosecond access times (vs milliseconds) and megabyte transfer rates (vs kilobytes/sec). The single quantity price for the unit is $19,500; capacity 1 MB to 4.35 MB.

• LOOKING AT THE E SERIES IN EUROPE: a new IDC study by its European offices indicates that the effect of the 4300 launch and recent IBM price moves will be to slow the growth of the IBM installed base from 13.5% per annum in recent years to 11% by 1981. As in the U.S., the 4300 has sparked a higher-than-expected level of interest from users . . . but unlike here, it isn't expected to devastate the PCM market. PCM-CPU makers, in fact says IDC Europa, will have a 5% share of the market by 1981. Even more successful will be independent software and maintenance vendors. For instance, 41% of the future 4300 users contacted by IDC Europa will use an independent DBMS system; 46% will use an independent teleprocessing monitor.

• AND, IN THE U.S., THERE'S SOME LIFE LEFT . . . Amdahl reports that it has just signed a $260 million multicurrency credit agreement with a group of 13 international banks.

• HOW PATRIOTIC CAN YOU GET? THANKS TO COMPUTERS, the positive balance of trade for the U.S. in computers, copiers, calculators, and other business equipment will approach $4 billion for 1979. In 1978, the balance was only

• NEW PROGRAMMING STANDARD RECOMMENDATIONS FROM NBS: Fortran and Minimal Basic to go alongside Cobol as a Federal Information Processing Standard.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" October 4, 1979 • VOL.15,NO.8 P.J. McGOVERN,PUBLISHER

No Proposition 13 in computers

FEDERAL GENERAL-PURPOSE DP EXPENDITURE GROWTH TO DROP TO 9% IN FY80 AS DEFENSE, HEW, AND ENERGY DEPARTMENTS SOAK UP 70% OF SPENDING GROWTH

"Annual obligations for general purpose data processing activities are expected to grow at a faster rate than the total Federal Budget during FY 1979 and FY 1980."

-- from an OMB summary of general purpose DP activities prepared in August 1979

Nestled in with the "bad news" of constantly increasing Federal spending is some "good news" for the DP industry . . . more of that money is going for DP equipment and services. In fact, at 1% of the total Federal budget, executive branch data processing costs are taking a bigger chunk than ever before. In addition, as the quote above indicates, DP expenditures are growing faster than the budget.

Counting only general-purpose CPUs -- not including classified DP, computers that are integral to weapons or other systems, analog computers, or legislative/judicial branch processing -- the Federal government should spend over $5 billion in the next twelve months (FY80). Last year the agencies spent just under $4.8 billion. In FY78, they spent $4.1 billion.

(27% of that spending in FY78 went for computer services, for which the Federal government relies heavily on the private sector . . . mostly in design studies, systems analysis, programming and operations. These services increases are countered by low growth in the government ADP workforce.)

In Federal spending for computing resources, as outlined to Congress in the 1979 Budget by the president's office of management and budget (OMB):

- The largest single buyer of DP equipment and services continues to be DOD, with a FY80 budget over $2.5 billion. Furthermore, the agency shows double-digit growth -- 12% more this FY over last, 18% the year before that.

- Next biggest spenders are the Department of the Treasury and HEW, both with over $500 million budgets. HEW also has double-digit growth in DP spending year-to-year for FY78 to FY80.

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AUTOMATIC DATA PROCESSING BUDGET DISTRIBUTION
(Dollars in Thousands)

	FY 78	FY 79 est.	FY 80 est.
Natural Resources, Energy and Science Agencies			
Department of Agriculture	94,328	109,863	119,858
Corps of Engineers	29,061	39,269	40,564
Department of the Interior	51,951	65,664	67,882
Department of Energy	277,018	306,940	351,568
Environmental Protection Agency	37,904	39,639	45,715
National Aeronautics and Space Administration	184,877	202,661	210,242
Tennessee Valley Administration	25,633	37,109	60,691
National Science Foundation	14,177	17,376	17,856
Other	9,407	11,639	11,763
TOTAL	724,356	830,160	926,139
Economic and Government Agencies			
Department of Commerce	107,658	125,608	140,211
Department of Justice	39,192	47,393	49,313
Department of the Treasury	520,906	557,764	586,208
Department of Transportation	69,359	85,478	98,495
General Services Administration	60,705	54,118	55,200
Office of Personnel Management	12,466	11,904	12,037
Department of Housing and Urban Development	18,898	22,354	27,648
Other	31,098	36,123	42,008
TOTAL	860,282	940,742	1,011,120
National Security and International Affairs Agencies			
Department of Defense	1,937,227	2,278,908	2,553,703
Department of State	12,380	18,562	20,977
Other	9,809	14,948	14,115
TOTAL	1,959,416	2,312,418	2,588,795
Human and Community Affairs Agencies			
Department of Health, Education and Welfare	432,194	494,616	531,202
Department of Labor	44,915	56,524	59,464
Veterans Administration	80,472	113,377	74,890
Other	22,501	25,578	27,742
TOTAL	580,082	690,095	693,298
GRAND TOTAL	4,124,136	4,773,415	5,219,352

(Source: OMB)

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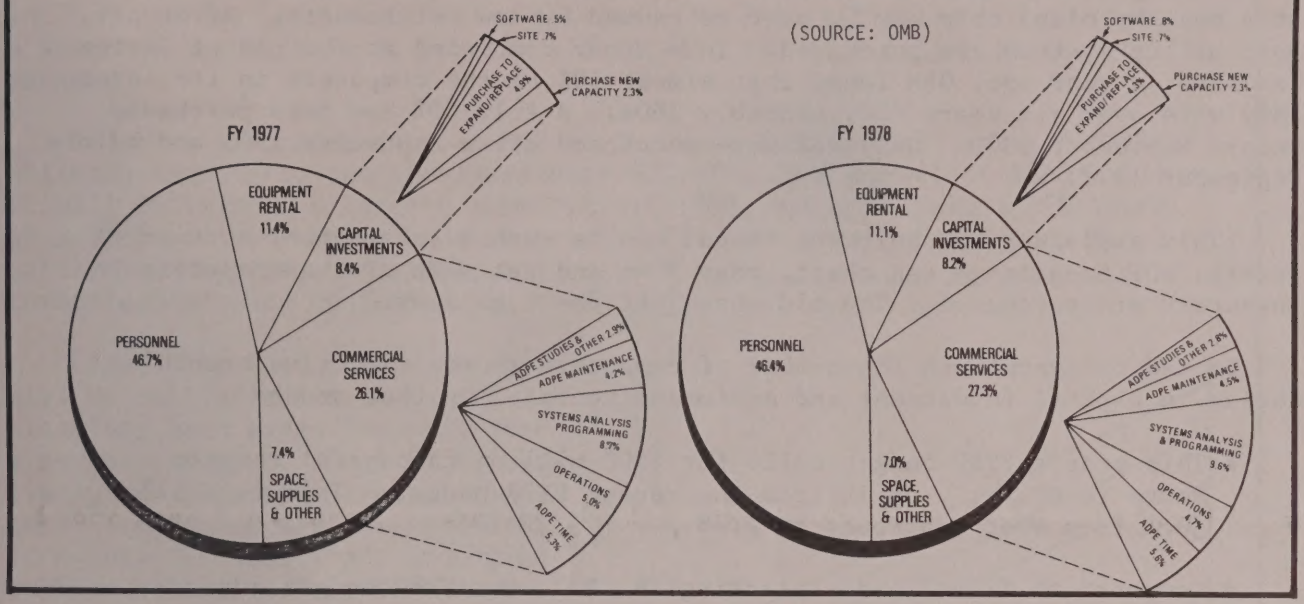
DISTRIBUTION OF EXECUTIVE BRANCH DATA PROCESSING COSTS

(SOURCE: OMB)



- The federal inventory of computers is increasing at a rapid rate -- from 11,518 computers at the end of FY77 to an expected 15,753 by the end of FY80 (next October), a four-year jump of 37%.

- Most computers are purchased -- 91%, to be exact -- which is almost exactly twice the purchase percentage in the commercial world.

- The Federal Government data processing work force has remained relatively stable over the last decade -- at 110-115 thousand staff years during the last decade, but it is growing slowly now.

EXECUTIVE BRANCH COMPUTERS OWNED AND LEASED (BY UNIT)
(SOURCE: OMB)

	FY 1974	FY 1975	FY 1976	FY 1977	FY 1978	FY 1979 (est.)	FY 1980 (est.)
General Management							
Owned	2,383	2,801	3,047	3,774	4,076	4,184	4,315
Leased	965	972	856	885	1,000	1,055	1,117
Total	3,348	3,773	3,903	4,659	5,076	5,239	5,432
(% Owned)	(71.2)	(74.2)	(78.1)	(81.0)	(80.3)	(79.9)	(79.4)
Special Management*							
Owned	4,163	5,018	5,782	6,630	7,890	9,194	10,030
Leased	286	192	193	229	215	223	291
Total	4,449	5,210	5,975	6,859	8,105	9,417	10,321
(% Owned)	(93.6)	(96.3)	(96.8)	(96.7)	(97.3)	(96.6)	(97.2)
Grand Total	7,797	8,983	9,878	11,518	13,181	14,656	15,753

*Primarily minicomputers and some dedicated application mainframes.

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Computer hardware: an aging crop

Although the numbers of computers in the executive branch are increasing at a healthy clip, this may in part be caused by low retirements. After all, most of the systems are purchased. In a study completed at the end of September 1978, a year ago, OBM found that almost 50% of the computers in its inventory were over six years old, probably 360s. A full 30% had been purchased before September 1970. Only 18% were purchased after September 1975 and before September 1978.

(This explains why equipment rental can be such a substantial portion of federal ADP budgets -- see chart, page 3 -- and yet most of the computers in inventory are purchased. The old ones just don't go away.)

Behind the growth in the number of computers is the executive branch's outlay in capital investment and equipment rental. On that score:

- This year's FY80 budget calls for $500 million in capital investments in DP . . . up 7% from the recent FY79 budget. This is a 52% jump from what was spent in FY78.

- Compared to fiscal years starting in 1973, the FY80 budget just about doubles the annual outlay during 1973-78.

- Equipment rental costs, which hovered between $425 and $460 million for four years (FY75 to FY78), are budgeted to exceed $680 million next year. This will be an 18% hike over rentals budgeted during the last fiscal year ending September 1979.

- Both capital investment and equipment rentals will increase their portion of the total DP budget by 2% . . . as personnel, space, supplies and others drop in response.

Services: going outside

Also increasing its cut of the total executive branch DP budget will be computer services, which are scheduled to jump from 27% of the budget in FY78 to 30% in FY80 . . . to $1.585 billion.

Next year's spending, in other words, will jump 17% over last year's, which jumped 20% over the year before (in part because of a spending shortfall in FY78). But this is not unusual. In other years, spending for computer services has growth 25% (FY77), 53% (FY76), 18% (FY75) . . . fitting talisman to the growth in this dynamic sector of the industry.

With fallout in manpower costs

In part because of the growth in the federal spending for computer services -- mainly for labor-intensive activities -- the growth in federal DP staff has been held relatively constant. Next year 121,000 man-years are budgeted.

But rest assured that this doesn't mean that costs aren't going up. They are, in fact, rising at about twice the rate of the number of employees . . . 3.5% from FY79 to FY80, 9.4% from FY78 to FY79. And this last

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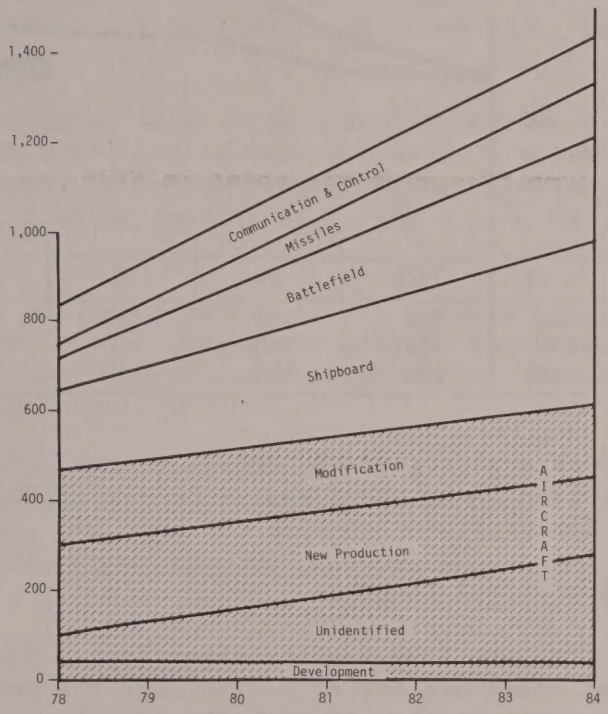
A LOOK AT THE COMPUTER NOT ON THE FEDERAL INVENTORY

There's a whole pile of computers not reported in the federal inventory -- including those used in military systems. Market statistics are elusive, but a New York research firm, Frost and Sullivan, has made a stab at gauging the market.

Military aircraft, says an F&S study, were the largest users of digital military computers, and commanded over 50% of a 1978 market of $860 million. It will still be the largest submarket in 1984, but with only a 37% share of a $1.5 billion market. Other growth will come in shipboard computers, battlefield systems, missiles, and communications and control.

DIGITAL COMPUTER MARKETS IN MILITARY SYSTEMS
(Source: Frost & Sullivan)



Especially fast growing areas will be battlefield systems and missiles, each expanding 200% over a seven-year span. (But from relatively small bases: digital computers in missiles was only a $40 million business last year, according to F&S; battlefield systems were $80 million.)

In military aircraft systems, "New Production" aircraft still represent the biggest market -- $1.35 billion from 1978 to 1984 -- but computers used in "Modifications" of existing systems will provide $1 billion to suppliers over the seven-year period. And digital computers used in unidentified programs will increase from a 1978 market of $60 million to 1984 market of $230 million.

In shipboard systems, Submarines will lead with an aggregate outlay of $475 million over the 1978-1984 period, with Command usage running a very close second ($471 million). Fire control, sonar, electronic warfare, and spare parts applications will also show impressive gains.

Among the battlefield markets -- a 1974-1984 aggregate of $1.2 billion -- targeting, reconnaissance and surveillance /and applications will garner about 50% of digital computer sales. The other major submarket, weapons systems, will take another 30%.

The other areas, missile applications and communication and control applications, will gobble up over $1 billion in digital computers over the seven-year span. Major programs include the Worldwide Military Command and Control Systems, Air Traffic Systems, Cruise Missile, and Trident programs.

(There will also be a small market in commercial aerospace computers, sparked, says the report, by Boeing's adding digital capability to its 727s and 737s.)

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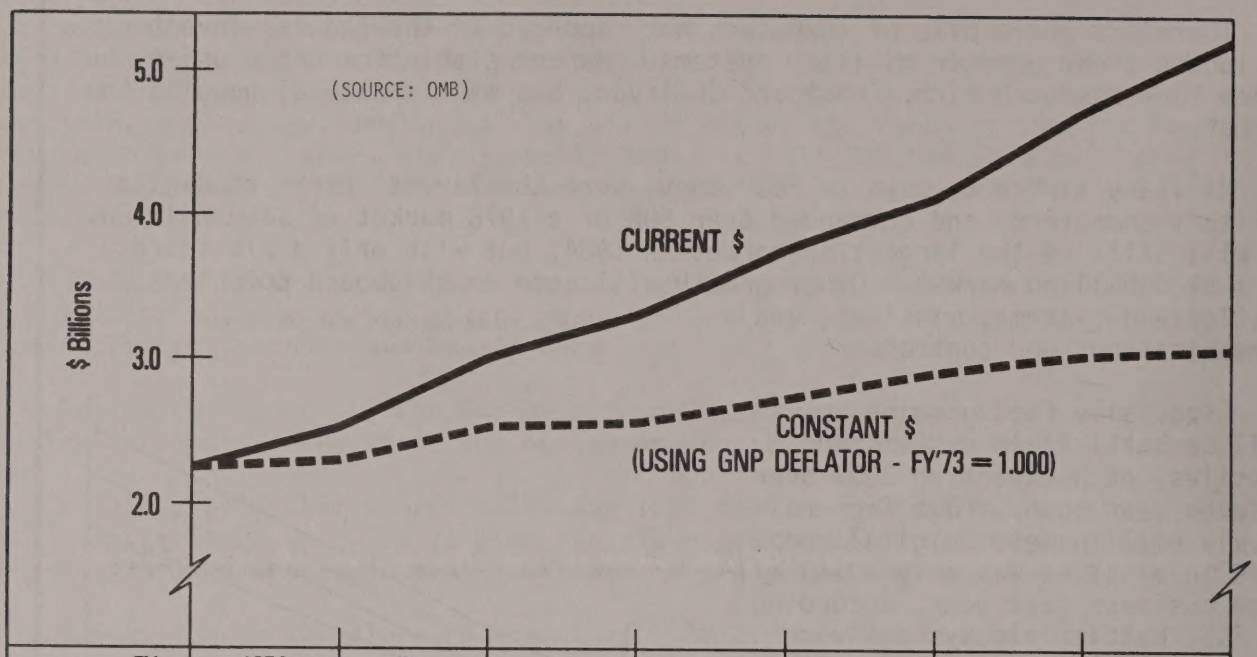
EXECUTIVE BRANCH DATA PROCESSING COSTS



FY	1974	'75	'76	'77	'78	'79 est.	'80 est.
ADP ($ Billions)	2.539	3.015	3.290	3.745	4.124	4.773	5.219
GNP DEFLATOR	1.0777	1.1933	1.277	1.3635	1.4456	1.5473	1.6835
ADJUSTED ADP	2.356	2.526	2.576	2.747	2.911	3.034	3.100

year was a watershed of sorts: Federal DP spending on personnel crossed the $2 billion mark. Next year's budget (FY80) calls for a budget of $2,187 million for staff.

Putting it all together

There are some healthy signs here. First is the fact that although personnel costs are rising faster than the workforce (hopefully there's some more productivity tucked in with the inflation), they are rising slower than the overall DP budget. The amount of purchase acquisitions and the longevity of systems points to some costs savings . . . unless new systems could save money in operating costs.

To explain real costs growth to Congress, OMB was kind enough to show its DP budget growth in terms of constant dollars -- although there are those who would argue that the government shouldn't be allowed to discount inflation since it's a prime cause. In that case, the executive branch's DP costs have only risen 32% in the last seven years, versus 105%.

Still, for DP suppliers, the federal government represents somewhat of a growth industry. And for employees and employers, a job source/sink. Some notes of interest on executive branch DP spending:

+ For equipment, it is 6% that of private industry (EDP/IR,Feb. 23,1979).

+ For services it's over 50% what the commercial sector spends.

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IBM ENTERS ITS SECOND JOINT VENTURE, JOINS WITH MCA TO MAKE AND MARKET VIDEO DISKS

In a deal that surprised observers in the video industry more than observers in the computer industry, IBM entered into its second joint venture in the decade by agreeing with MCA, Inc., to be an equal partner in a new firm -- DiscoVision -- that will make and market video disks.

IBM will input its patents, technology, and other video disk assets -- and cash -- while MCA will fork over its current video disk business, including patents and technology, but retain programming copyrights and distribution. IBM and MCA will share profits equally after a specified (but unrevealed time); until then, MCA will take a majority. At press time, MCA had already turned over 50% interest in Universal Pioneer Corp., formed in 1977 by MCA and Pioneer Electronics Corp. to manufacture industrial video disks and players.

The new venture will be called Discovision Associates and will be headed -- on a commitment that lasts only through the end of the year -- by a former MCA vice president. Second-in-command will be an IBM vice president. Policy will be set by an Associates Committee, chaired jointly by an IBM senior vp and MCA's current president.

DiscoVision's first charter will be selling products to the industrial market, but even Frank Cary has admitted it will ultimately aim to "broaden the use of video disk technology in the home entertainment, industrial education, and information fields." EDP/IR notes:

- IBM has done this before -- Satellite Business Systems -- with a similar management setup and rationale of complementary expertise.
- If IBM wanted only to use video disk technology in its own, current business, it wouldn't need MCA.
- Video disks make excellent distribution vehicles for software or educational materials.

What about computer applications? Phillips Magnavox has an optical disk recorder that can store 2.5 trillion bytes of a dual-sided disk -- and a player may cost as little as $10,000 in future OEM quantities, with disks costing $150 -- that might be seen as a microform competitor. (Phillips, by the way, is a partner with MCA in a video disk business . . . no one's said what happens now that DiscoVision exists.) And rumors persist that RCA and Kodak are at work on optical disks that might have computer room relevance.

But EDP/IR sees more here . . . a phased approach to the home market via industry and academia. Almost a form of market research for the Giant, much as the 3790 was the research into DDP that lead to the 8100.

And once that market research is done, IBM might break the ice with a home video-disk player (so far DiscoVision only address the disks themselves) . . . perhaps one with intelligence. Or capacity to communicate to data bases at the other end of a phone line. Meanwhile, the Giant has placed a small toe tentatively into new waters . . . the denizens of which must clearly see the foot, leg, and torso beyond it.

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• IBM VERSUS ~~EDELSTEIN~~ (OOPS) JUSTICE CASE CONTINUES ITS ROCKY WAY, with IBM now at the appellate court level (EDP/IR,Aug.6,1979). Judge Edelstein, understandably, ruled that he was not prejudiced against IBM. In the meantime, both Edelstein and the judges at the Second Circuit Court of Appeals have ruled that the trial must continue while the matter is contested. Also in the interim, settlement proposals and charges of "absurdity" have flown from side to side regarding the proposals.

And in another venue, Transamerica, which is waiting for Judge Robert Schnake to rule on its suit against IBM (the jury couldn't decide), has asked that judge to disregard an appellate court ruling against CalComp. Transamerica feels that the "permissive" attitude displayed in the CalComp ruling could adversely affect its own trial.

• WHEN IBM LOOKED TO ITS CASH CUPBOARD . . . it decided a little more green would come in handy in building facilities to pump out all those 4300s and follow-on computers it has on backlog. Having established a $1.5 billion line of credit with a gaggle of 37 banks, this time the firm decided it would go to the bond market. The company will seek $500 million in 7-year debentures, $500 million in 25-year notes. And more outside financing may follow.

• AMDAHL ADDS SOME SOFTWARE KICKERS TO ITS 470 LINE: One, a set of new releases for its VM/Performance Enhancement software, the other a set of "Amdahl Internally Developed Software (AIDS)" that will boost 370 IMS performance. The company also announced a hardware measurement interface, which preprocesses signals from 470V/7As, 7s, and 8s, and puts them into the scope of most commercial monitors. The Amdahl boosts come in the wake of some recent IBM pricing actions: 1) the extension of its trade-in plans for the 158 the 138 and 148 (users purchasing rented CPUs will get a guaranteed trade-in allowance at a specified future date, 2) purchase prices for attached processor units of 158s and 168s were cut 25%. Speculation is now rife that either a new 303X will soon appear or 303X price cuts will ensue.

• A POWERFUL NEW LINE OF LARGE-SCALE COMPUTERS WITH A NEW OPERATING SYSTEM was to be announced by Honeywell as EDP/IR went to press. Based "on new technologies" the systems will put Honeywell firmly into the large-mainframe picture. A single processor of the largest model of the DPS 8 line (the model 70) will be twice as powerful as anything HIS offers at present . . . and this model can be configured with up to four processors. In making the announcement, HIS quickly points out that the new operating system will run programs already written for Honeywell equipment, protecting user investment in software. Details will be analyzed in the next issue of EDP/IR.

• WHAT ANOTHER COMPANY ONCE DID WITH THE "LIBERATOR," WANG NOW DOES . . . i.e., offers conversion packages for IBM System/3 users. (The other company was Honeywell, it's approach was moderately successful.) The most significant of the programs -- which will also help System/32 users -- according to Wang will provide semi-automatic conversion of programs which support interactive screen operations using IBM's Communications Control Program. The aids will be offered free to IBM users switching to Wang.

• FUJITSU WILL GET A MARKETING ARM IN THE U.S. THROUGH TRW in an as-yet-undefined joint company for marketing information processing products.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" OCTOBER 23, 1979 • VOL.15,NO.9 P.J. McGOVERN,PUBLISHER

8/70MP is HIS' largest system ever -- in 3033MP range

HONEYWELL SPRUCES UP LINE WITH DPS 8S, NEW GCOS, UNBUNDLED OPERATING SYSTEMS

Perhaps Honeywell was hoping its fall announcement of four systems, a new operating system, disk, controllers and unbundled software and service support would read like the earthshaking IBM 4300 announcement this past spring. It didn't. The plethora of pages from Honeywell hardly mentioned new technology other than increased use of microprocessors and "LSI circuitry."

But for Honeywell users and those intrigued with the company's distributed data processing stance, the DPS 8 announcement represents a solid building block of remote processing systems. HIS looked more kindly on its installed base than IBM did with its 4300 announcement; the new OS, disk, and mass storage processors can be used with certain existing large systems.

What is new, although admittedly in an "evolutionary" sense, is the Gcos 8 operating system, which is designed to prevent communications-type functions from taxing the CPU. And the mass storage processors are new for Honeywell.

The announcement represents Honeywell's move to align its offerings more closely with the price/performance curve set by IBM. For why otherwise would the company introduce within one calendar year a second set of hardware that apparently obsoletes the first, known as the 66 DPS? The new models represent price/performance improvements over comparable previous hardware of from 5% to 28%. Instead of bracketing the 4300 line, HIS filled some gaps in its upper end. HIS announced:

- Four models of CPU, the DPS 8/20, /44, /52 and /70. In contrast with the DPS 64 and 66 lines, only the /70 is a multiprocessor configuration, taking a maximum of four processors. The 8s range in power from the 8/20, about twice that of the 4331, to the 8/70, which is in the range of a 3033MP. The single 8/70 is twice the power of the previous top-of-the-line 66/80 in single configuration.

- Unbundled operating systems and a service support scheme similar to that of IBM. The fees charged for license and extra support -- house calls -- equals the previous license fee for most software. The monthly license fee includes updates and remote diagnostic

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capability with access to hot lines. Although the Gcos 8 operating system executive (OSE) is "free," the modules are licensed. The fee for optional expanded support for the OSE is based on the size of the CPU, whereas the fees for expanded support of other software vary depending on the product.

- Gcos 8 operating system, an "evolutionary and modular version" of Gcos that features enhanced transaction processing capabilities and more data security. A novel HIS feature is an integrated transaction processor designed to spread the load over multiple processors.

- More extensive use of virtual memory, which Honeywell labels logical memory.

- Four mass storage processors and a $49,650 1.1 billion byte disk drive that features 12 platters (20 recording surfaces) and conventional core heads. The processors (some standalone, some integrated and some half-and-half) are designed to handle the flow of data from disk to the I/O multiplexer, aided by microcoded controller programs.

Hardware

The hardware contains few technological innovations, if any. HIS is using more microprocessors than it has in previous machines. The memory is 16K chips with varying costs for a 1M byte depending on the system. For instance, on the two smaller machines the memory is synchronous and 1M costs $15K. But on the two larger CPUs, which have asynchronous memory, the price is $40K. The two smaller machines are program controlled, whereas the others are hardwired. One cannot upgrade throughout the line. Rather, the /20 can grow to a /44 and a /52 to a /70, but one cannot jump from a /44 to a /52.

With a new product line comes the question: Whatever happened to CML, current mode logic, that was to have been the fabrication technique used in chips on the stillborn 66/85 that never made it out of the plant? HIS at that time said CML was not cost-effective. HIS now says it has mastered the techniques of making CML in a more cost-effective way than the days of the 66/85, and is using it in defense-related products. But HIS apparently cannot make the stuff in the requisite cost-effective manner for the commercial computer market.

HOW 8s STACK UP

HIS 8s	Price	IBM	Other HIS
8/20	149,048	about 2x 4331	75% above 66/05
8/44	225,500	same as 4341	same as 2M DPS 440
8/52	556,791	same as 3031	33% above DPS 520
8/70	1,156,399	slightly below 3032	about 2x 66/80
8/70MP	3,833,095 (4 CPUs)	about 3033MP	

Honeywell's performance figures are based on Gcos 8 on the 8s. The prices are based on basic CPU, I/O multiplexer and 1M bytes of memory.

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PRICE/PERFORMANCE

Honeywell offered price/performance comparisons of new to old systems based on two configurations -- a typical system with hardware only, and a typical configuration with hardware and software and bells and whistles. The hardware prices are purchase prices, and software is based on a five-year lease. Details on what constitutes specific systems are lacking. The greatest improvement can be found in comparisons with the older 66s; the 440s are less than a year old.

	New		Old
	DPS 8/20 (1M)		DPS 440 (1M)
Performance	19% below		
Hardware Only Price	$503,858	7% below	$540,085
Hardware, Software	$780,858	6% below	$834,865
	DPS 8/44 (1M)		DPS 442 (2M)
Performance	equal		
Hardware Only Price	$670,355	6% below	$712,179
Hardware, Software	$1,008,995	5% below	$1,067,679
	DPS 8/52 (1M)		66 DPS 1
Performance	assume same but is 5%-6% faster		
Hardware Only Price	$1,179,036	28% below	$1,644,568
Hardware, Software	$1,724,166	22% below	$2,201,668
	DPS 8/70 (2M)		66 DPS 3 (dual)
Performance	9% below		
Hardware Only Price	$2,193,365	27% below	$3,015,107
Hardware, Software	$3,065,165	22% below	$3,953,567

Peripherals emphasize offloading CPU

The mass storage processors, ranging in price from $39K to $62.5K, handle such transfer functions as address conversions, formatting, seeks and overlapping, in addition to I/O command retries and alternate track processing. All these capabilities are aided by microcoded programs designed to reduce CPU overhead and by some microprocessing support.

The new disk, the MSU0501, is nearly double the size of IBM's 3770 and much less expensive on a per byte basis -- perhaps because it uses conventional core technology in the head and is slower. The HIS unit, with 1.1 billion 9-bit bytes, costs $49,650 and rents for $1,296/mo on a five-year plan. The IBM 3770 has 571M bytes and costs $35,100 with $900/mo rental on a two year plan. The HIS unit has 662 track/in. and 6,436 bit/in. with average seek time of 25 msec. The effective transfer rate is 983,000 byte/sec (1.065 Mbyte/sec max) while IBM's transfer rate is 1.859 Mbyte/sec.

Unlike IBM, HIS allows its new disk to function on existing machines such as the 66 and 66/DPS.

Software -- where the action is

Gcos 8, termed "evolutionary," will handle files and programs of Gcos III. The new system's focus appears to be on transaction processing and communications. HIS said measurements comparing the two systems are incomplete, but it appears Gcos 8 is slightly faster. The new version won't be out until

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third quarter 1980, whereas hardware shipments begin the second quarter. Users of certain 66/DPS and non-DPS large systems will be able to run Gcos 8, which again shows more willingness than IBM to upgrade existing systems with plums from the new announcement.

Honeywell has adopted in full the virtual memory concept, with memory managed in terms of segments. Previously Honeywell's involvement with virtual was limited to the Level 66's virtual unit addressing capabilities.

Gcos 8 is much stronger in multiprogramming with its ability to handle 488 concurrent user processes compared with 64 on previous systems. It can also handle 216 channels on the 70 MP system. But Gcos 8 is also designed to be all things to all people -- handling concurrently eight modes such as transaction processing, batch, time-sharing and diagnostics tasks.

The star feature appears to be the module called Data Management-IV Integrated Transaction Processing (DM-IV/ITP), designed to "spread a large transaction processing load over multiple processors." Under Gcos 8 in a multiprocessor configuration, any of the transaction processing routines (TPR) that comprise the DM-IV/ITP environment can be handled in any CPU, HIS said. Existing TPRs under the previous DM-IV/TP have to be relinked to be used in the new environment. The TPRs are programmed in Cobol 74 and each has its own domain. DM-IV/ITP comes in two versions: The comprehensive facility carries a monthly license fee of $2,060 with a $395 support charge, while the system managment facility costs $1,065/mo with a support charge of $185. Monthly fees and support charges of the system performance analysis facility are $175 and $25.

Time-sharing capabilities are said to be enhanced, with the entire real storage except for the OS residence available to time-sharing. Up to 400 concurrent users can be supported, HIS said. There's a multicopy time-sharing option that allows four separate time-sharing worlds to operate concurrently by MP configurations.

Using techniques of the Multics system, Honeywell has added hardware security capabilities to Gcos 8.

Coupling of CPUs

Honeywell said one can tightly couple various models of the 8, and also 8s with 66s if they use the same operating system. All systems linked via communications should be running the same OS. There's a feature in the Gcos 8 that provides online processor reconfiguration.

Fitting together the pieces

Billed as "systems for the 1980s," the DPS 8s "climax a decade that has seen the company's large-computer user base grow from a hundred to well over 2,000 computer systems with an installed value of over $4 billion," according to Stephen G. Jerritts, vice-president, general manager of Honeywell's U.S. computer operations. HIS' installed mainframe base is twice as large outside the U.S. as within as of year end 1978 -- 8,519 vs. 4,233, according to the IDC census (EDP/IR Review & Forecast June 29). But the Series 60 breakout shows nearly four times as many systems abroad as in the U.S. -- 4,103 to 1,447. And the Xerox base adds 601 mainframes worldwide, which undoubtedly helped fuel the growth Jerritts referred to.

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Honeywell has honored its commitment to the Xerox base it acquired, most notably by introducing a new version of the Xerox operating system, CP 6, that happens to run on a version of the 66/DPS, thus dealing Xerox Sigma booster Telefile a strong whack. And there's a kind of twist in that Xerox recently contracted with HIS to install $23 million worth of Level 6s and CRTs -- 110 minis and 2,100 CRTs -- for inhouse use in customer service, field administration and materials control. Guess the Xerox 3200 wasn't up to the job.

Honeywell's large system division has been spewing forth announcements at a great rate during 1979. Taken as a whole, they indicate the company thinks it is serious about staying and solidifying its position in that sector of the industry. But there is little question in the minds of many observors that Honewell's Level 6 mini is really the lead-in factor to many sales.

Luckily for Honeywell, it has not concentrated solely on throwing hardware on the block, but rather has ensured operating system compatibility throughout its line including the Level 6s and woven the fabric of distributed processing with its DSE (distributed systems environment) announced in January 1977 but begun in 1974 with the Series 60. And the DMV-IV arrived in 1978, which was also the year when HIS began unbundling software with the Level 66/DPS line announcement. There were separate charges for several functions of that version of Gcos. HIS has also introduced goodies throughout the year designed to make the systems versatile and easy to use. But a good portion of effort must have been devoted to such exercises as expanding from four to six the number of processors that could be attached to 66s and 66/DPS last summer.

- DP1 of Network Process Supervisor (NPS) for 66/DPS which handles the flow between terminals, satellites and hosts under Gcos (March).

- Multics 7.0 for 68 and 68/DPS that allows use of four front end processors (April).

- Software for 66 and 66/DPS to expand to six-processor systems, eight front ends, and to facilitate multiprogramming, and T/S support (summer).

- Project Management and Control System PMCS/66 Interactive Input Processor PII with novice and experienced modes, including prompting, for 66 and 66/DPS (summer).

- Release 2 of IDS-II integrated data store on 66, 66/DPS and Series 6000 that facilitates use of Fortran in time-sharing (summer).

So, with all that investment in software this past year, it's a good thing for Honeywell as well as the users that the new OS is compatible. But what of the DPS 66 hardware, only announced this year, that is now obsolete for all practical purposes?

And management moves indicate HIS has put marketing types in charge of the divisions that produce hardware; assigned field services to report to the marketing services division, and clarified the systems and manufacturing roles within the small/medium division. In addition, there has been further reorganization of selling Level 6 according to the buyer. Marketing services handles sales to the end user but the small/medium division retains sales to the OEM and systems houses. Honeywell is also more closely targeting industry sales -- as in the creation of a financial industry group at Incoterm.

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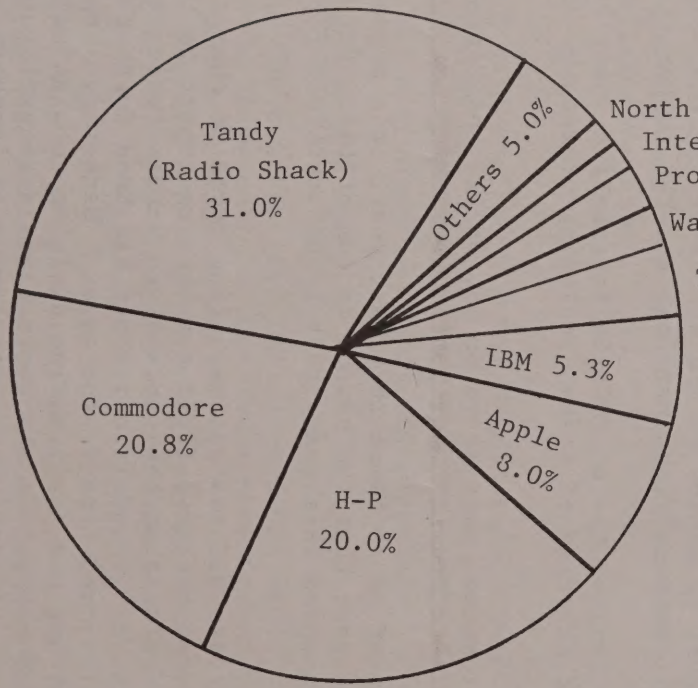
DESKTOP COMPUTERS INSTALLED WORLDWIDE
(U.S.-Based Manufacturers -- Yearend 1978 Data -- See Page 7)



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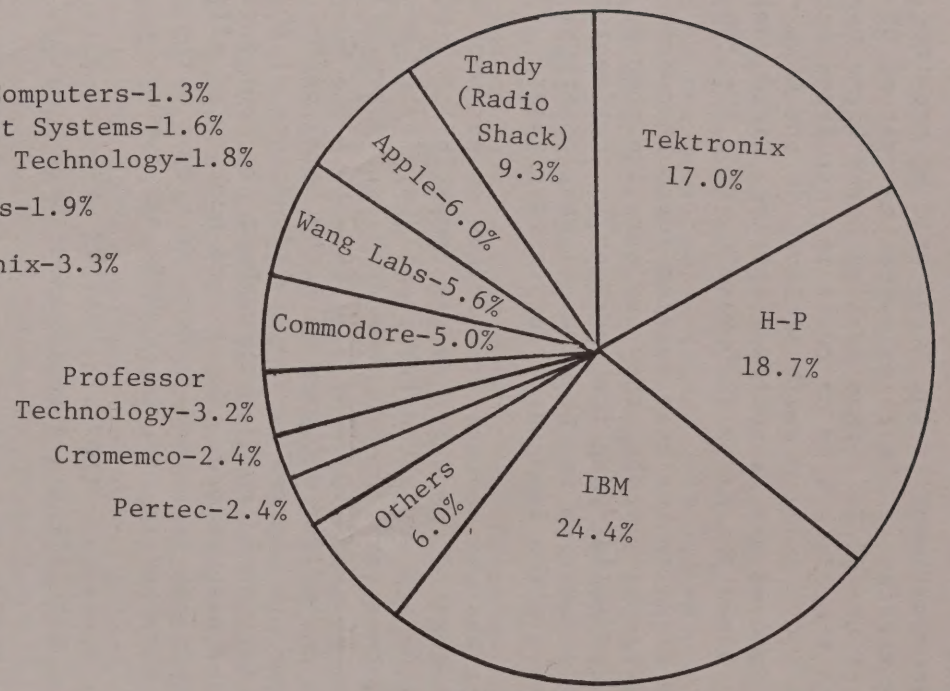

Value-$750 Million

With the Desktop Computer Census published in this issue (Page 7), International Data Corp. (EDP/IR's publisher) begins its statistical coverage of the lowest stratum in the computer hierarchy. Various names (personal computers, microcomputers, etc.) abound for this new breed of equipment; IDC has settled on "desktop" to include all members of this group of inexpensive computers.

The entries break down into four major categories, each with its own characteristics. They are:

+Business/Professional -- The fastest-growing sector, with an average system value of $3K. Some 57,000 were installed at yearend 1978.

+Home/Hobbyist -- The sector where most units are installed today (69,000 at YE78), these sell for about $1,100 and are expected to cost less over time.

+Scientific -- The most expensive category ($15K average system value), there are about 27,000 in place today. Growth should parallel that of minis.

+Education -- Some 13,000 were installed at YE 78 with an average system value of $1,100. Many don't have printers attached to the CPU.

In general, IDC sees increased use of desktop computers in business, with prices declining over time. Many will access data bases via telephone or CTV lines.

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DESKTOP COMPUTER CENSUS

The Desktop Computer Census counts those computers which typically are small enough to be used on a desktop, and are found in a variety of end-user environments including business, home, hobby, personal, educational, and scientific. By IDC definition the Desktop Computer is microprocessor based, includes its own power supply and enclosure, has the capability for attaching output peripherals -- video screen and/or printer -- and can also attach storage devices such as floppy diskettes, tape cassettes, or in some cases fixed disks. The computer is programmable in BASIC or equivalent level language, and costs from less than $1,000 up to $15,000 in a basic configuration. Microcomputer boards and kits are not counted here.

AS OF JANUARY 1, 1979

MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	PURCHASE PRICE IN DOLLARS BASIC	PURCHASE PRICE IN DOLLARS AVERAGE	DATE OF FIRST INSTALLATION	IN U.S.	OUTSIDE U.S.	WORLD TOTAL	ESTIMATED 1979 INSTALLATIONS
Apple Computer Co.	Apple II	6502	1,195	2,500	5/77	14,000	4,000	18,000	45,000
Atari	400	6502	550	550	9/79	-	-	-	) 1,000
	800	6502	1,000	1,000	9/79	-	-	-	)
Compal	8100	8080	9,775	12,000	10/76	400	-	400	200
	8200	Z80	11,995	14,000	11/79	-	-	-	30
Commodore Business Machines	Pet	6502	595	795	10/77	34,000	13,000	47,000	80,000
Compucorp	625	Z80	7,000	10,000	9/77	200	600	800	200
	655	Z80	5,400	8,500	5/79	-	-	-	150
	665	Z80	6,700	10,500	5/79	-	-	-	450
Computer Data Systems	Versatile 4	8085	3,800	4,500	11/77	400	75	475	600
	Versatie 3B	8085	4,900	5,500	11/77	150	25	175	300
Cromemco	System Three	Z80A	8,080	12,000	8/77	1,400	100	1,500	3,000
Digital Microsystems	DSC-2	Z80A	4,995	5,895	11/77	400	50	450	1,000
	DSC-2 SBS	Z80A	9,950	9,950	6/78	50	-	50	500
	DSC-86	8086	5,995		/79	-	-	-	100
	DSC-86 SBS	8086	12,950		/79	-	-	-	100
Durango Systems	F85	8085A	12,983	13,517	10/78	15	-	15	1,000
Dynabyte	DB8/1	Z80	2,295	6,000	/78	45	30	75	370
	DB8/2	Z80	4,395	7,000	/78	30	10	40	180
Exidy	Sorcerer	Z80	995	2,200	8/78	1,000	1,000	2,000	10,000
General Robotics	Polaris	LSI-11	13,000	13,000	4/78	-	100	100	200
Heath	WH89	Z80	2,295	2,500	/79	-	-	-	1,000
Hewlett-Packard	9825	HP	5,900	11,000	1/76	17,000	23,000	40,000	)
	9835	HP	9,000	13,000	12/78	50	50	100	) 25,000
	9845	HP	12,000	28,000	11/77	2,000	3,000	5,000	)
IMSAI	VDP-40	8085	5,300	5,300	/78	190	10	200	200
	VDP-80	8085	7,800	7,800	/77	500	100	600	200
Industrial Microsystems	5000	8080, Z80	3,300	3,300	6/79	-	-	-	400
	8000	8080, Z80	4,700	4,700	6/79	-	-	-	400
Intelligent Systems	8051	8080A	3,650	4,200	/76	2,100	900	3,000	) 2,000
	3621	8080A	3,300	3,300	7/79	-	-	-	)
	Compucolor 2	8080A	1,600	1,800	9/78	600	-	600	4,500
Interactive Computer Systems	MCM 900	2901	9,200	20,000	2/79	-	-	-	200
	MCM 800	Bipolar	8,600	17,000	1/77	100	120	220	25
	MCM 700	8008	7,200	12,000	3/75	50	100	150	-
IBM Corporation	5100	IBM	6,300	13,000	11/75	4,300	1,000	5,300	100
	5110	IBM	9,900	17,000	2/78	6,000	700	6,700	9,000
Micro V Corporation	Microstar I	8085A	7,500	15,000	8/78	25	25	50	500
Midwest Scientific	MSI-6800AW	6800	3,895	3,895	5/79	-	-	-	100
North Star Computers	Horizon	Z80A	2,315	2,765	12/77	2,500	450	2,950	6,000
Northwest Microcomputers	NMS 85/P	8085	8,500	8,500	1/78	5	25	30	NA
Odell Industries	System 85	8085A	10,450	15,500	6/78	30	-	30	NA
Ohio Scientific	Challenger	6502/6800/ Z80	1,260	2,500	/78	500	-	500	1,500
Pertec Computer Corporation	PCC2000	8085A	9,995	13,120	9/78	70	20	90	1,500
	MITS 300/25/55	8080	8,080	13,800	/77	1,050	150	1,200	100
Polymorphic Systems	8813	8080	4,375	5,800	9/77	1,500	200	1,700	900
Processor Technology	Sol I/II/III/IV	8080A	3,000	6,000	/77	3,600	400	4,000	1,000
R2E of America	80/30	Z80	5,000	7,000	7/79	-	-	-	20
(U.S. Only)	80/40	8080	7,000	8,500	7/76	20	-	20	50
	80/50	8080	12,000	15,000	7/75	5	-	5	20
Smoke Signal Broadcasting	Chieftan	6800	2,595	3,000	3/79	-	-	-	500
Solid State Technology	Athena 8285	8085A	8,000	10,000	/79	-	-	-	450
Space Byte Computer	DBM/1	8085	5,900	12,500	7/78	55	10	65	65
	DBM/2	Z80	5,900	12,500	6/79	-	-	-	125
Tandy Radio Shack	TRS-80/I	Z80	499	1,000	9/77	63,000	7,000	70,000	105,000
	TRS-80/II	Z80	3,450	5,000	7/79	-	-	-	5,000
Tano Corporation	Outpost 11	6800	2,595	3,500	8/78	75	-	75	600
	Outpost 7	6800	3,000	4,000	8/77	180	20	200	50
Tektronix	4051	6800	5,995	17,000	12/75	5,000	2,500	7,500	4,000
Texas Instruments	99/4	TI9900	1,150	1,300	/79	-	-	-	6,000
Vector Graphic	System B	Z80	4,750		1/79	-	-	-	) 3,500
	Memowrite	Z80	8,950		1/79	-	-	-	)
Wang Laboratories	PCS1	Wang 2200	5,400	8,000	4/76	800	300	1,100	-
	PCS2	Wang 2200	4,800	10,000	4/77	2,000	1,300	3,300	2,200
TOTAL						165,395	60,370	225,765	

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• SOUR GRAPES? The Computer and Business Equipment Manufacturers Association (Cbema), after losing its argument against federal standardization of the I/O interface along IBM designs, has announced it no longer will completely fund the secretariat costs associated with development of voluntary American National Standards Institute standards for DP-related systems. Cbema said the costs of acting as the secretariat are projected in excess of $200,000 for 1980 and that those who benefit from the program should pay for it.

• ADD ANOTHER COMPUTER MANUFACTURER -- this time one with a formidable amount of expertise in communications and architecture. Bolt Beranek and Newman Inc. formed the BBN Computer Corporation, a wholly owned subsidiary that will make and market the Pluribus computer and other new products based on BBN research. The Pluribus was first used in the Arpanet and has been modified and used in other packet switching networks as a node. BBN helped design Arpanet and also founded Telenet Corp. Frank E. Heart and W.B. Barker are chairman and president, respectively, of BBN Computer.

• JUST THE BEGINNING. IBM has "discovered" graphics in its latest barrage of terminal and printer announcements. The 3101, selling for $1,295 to $1,520 in single quantity, should not be discounted as an overpriced dumb TTY replacement (it's pretty competitive at the upper end.) Actually, it's probably IBM's vehicle to be upgraded and placed into home and word processing environments. In the meantime, it's Ascii-compatible, can be upgraded to include nearly all editing functions needed for word processing, and can run as a cheap SNA terminal under ACF/VTAM's V2/R3 and NTO. In addition, it's Data Processing Division's first effort at quantity discounts, ranging up to 20% for 100 units or more. Also, customers are expected to do their own repairs. IBM Japan makes the 3101 and the 3102 thermal printer that prints images off the screen.

Graphics software, announced along with the new, color 3279 terminal, costs only $160/mo plus $60/mo basic support, but needs around 200+K of CPU memory. Graphics capability, along with partitioned screens, is also available on the 8775, the 8100's terminal. The software is designed to allow construction of graphs without programming knowledge. The 3279 costs from $4,300 to $6,700, and the four-color printer, the 3287, costs $6,125 to $6,500. EDP/IR suspects at least one IBMer has been using in-house color CRTs to draft graphics to make slides for presentations. Resolution is very good.

• IBM's LEGAL EAGLES COMPILE IMPRESSIVE RECORD as District Judge Robert Schnacke ruled that Transamerica Computer Corporaton had failed to prove that IBM had monopoly power. Ending a six-year-old multimillion-dollar suit, Transamerica's suit alleged that IBM had monopolized the general-purpose computer market and the market for disk and tape drives. One of the Telex-tag-along cases, this suit differed from the others in that both parties agreed to leave the ruling to the judge, when the jury could not reach a verdict in July. According to TCC, it will go the appeals route.

• DATA GENERAL IS SIGNING DISTRIBUTORS for its Micronova line of microcomputers and peripherals. The latest is Almac/Stroum Electronics of Seattle.

• ROCKWELL IS CREATING AN AVIONICS BUBBLE under a contract from the Air Force to develop a 4M bit/sec memory expandable from 16M to 320M bits.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" NOVEMBER 4, 1979 • VOL.15,NO.10 P.J. McGOVERN,PUBLISHER

High-flier thuds to earth

INTEL, NATIONAL SEMICONDUCTOR EXTEND REACH INTO SYSTEMS DOMAINS VIA DIFFERENT ROUTES

The times they are a changing, and semiconductor manufacturers are doing their best to keep abreast of the changes. No longer can mainframers and mini makers look with dispassion at semi houses as they could when the semimakers were essentially components suppliers.

Just as the mainframer and later the mini maker realized the customer wanted software and service, so too are the semiconductor houses entering that stage. With microprocessors as powerful as the upper end of the Digital Equipment PDP 11 line, it is time to recognize that the semiconductor houses have embarked on a new phase, and probably will accomplish that phase faster than did their predecessors.

What does this mean for the industry? More competition and a wider range of choices for any given performance specifications. Let's face it, many of the mini and even mainframers' products now are comprised essentially of microprocessors, either custom or off the shelf from outside suppliers or from the vendor's own plants.

Why would semi makers venture outside of their own realms to join the fray of dealing with fickle end users or with small systems houses? One supposes it is the lure of the dollar, but then again, perhaps they think they can do it better. Indeed, if one looks down the road, it isn't hard to opine that it will be the semiconductor makers who will in fact solve the software price barrier by imbedding software into firmware. EDP/IR suggests this will happen in a more major way in the future. They are already selecting different architectures that optimize the use of higher level languages. Intel has some startling figures on how much less a program costs to create in higher level language than in Assembler.

But the means by which semiconductor makers are entering the systems arena are diverse, to say the least. National Semiconductor, after some ill-fated attempts to grow and market its own products, has contracted to take over Itel's sales and service force, thus putting it squarely in the business of dealing with the end user. Intel, on the other hand, is growing from within, and targeting specific industry areas, such as manufacturing automation, for

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its single board computer systems. Intel currently deals with systems houses, but this could change, should it wish to put capital into a marketing force.

One man's milk is another man's poison

In one fell swoop, National has obtained from Itel the wherewithal to position itself prominently in the mainframe business:

- Itel's marketing and service force
- Itel's inventory of CPUs (both National and Hitachi) as well as peripherals.

And National isn't planning to stop there. It is negotiating with other vendors such as Siemens (for its page printer), IPL, and others and intends to supply a wide range of processors and peripherals, primarily in the medium to large class of systems.

National never really got its feet wet in marketing to the end user other than in its point of sale business. And its only computer systems thus far have been the smaller models it sold on an OEM basis to Itel as part of its AS line. Indeed, National has had more than a couple of false starts in the computer industry.

- The 400, intended to be a plug compatible IBM mini, was announced in late spring, 1978, but killed after IBM changed the price/-performance ground rules with its 4300s. Also, there was a certain amount of confusion whether National would market to the end user. Some claim it did mention end user marketing but National stated later that the target was the OEM.
- The 8500, announced late spring 1979, apparently with the intent of marketing to end users. Itel balked, and threatened dissolution of its OEM contract. National retrenched, and is considering putting the machine, pegged at 1.5 times faster than a 148, into the AS line.
- National also tried to go head to head in the mini industry with a DEC compatible machine, but decided not to play that game in the face of lawsuits from DEC.

Terms Advantageous to National

EDP/IR thinks National made out like a bandit in its negotiations with Itel, whose position can be compared with that of a person trying to trade in a car that doesn't run. National acquired a highly trained, esteemed sales and service force -- sales people some 1,600 strong -- and estimates it saved five years and $20 million in startup marketing costs.

Itel is throwing into the deal $7.5 million of working capital through 1980 for use by National's subsidiary handling the newly acquired systems business, National Advanced Systems Corp. (NAS). NAS will market Itel's inventory (valued at $120 million as of June 30) and provide maintenance to Itel's existing base. And any losses sustained during the first three months transition period are Itel's responsibility. It appears National Semi has little to lose and lots to gain.

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As if that weren't enough, apparently there is a clause that pegs sales of National's own CPU inventory to Itel's inventory. Accordingly, a salesman is only obligated to handle an Itel machine (including those National has already sold to Itel) after it places one from National's inventory. Word has it that the contract between Itel and National was due to expire in mid 1980, so National had more leverage.

HIGH FLIER STILL HAS WHEELS

Itel Corp. has been known as something of a high flier, operated by very smooth, suave folk who were willing to engage heavily in leverage leasing of computers. Eventually, Itel acted as marketer for a line of IBM-compatible machines and then decided to expand even more within the industry by voraciously acquiring service bureaus.

Results from 1978 apparently led Itel to think the PCM business a veritable gold mine. It had posted an operating profit of over $50 million on shipments of about 200 Advanced Systems. Itel decided to increase its PCM effort in 1979 and boosted its marketing force by around 80% -- despite anticipation throughout the industry that IBM would announce its E series early that year.

As the market softened after IBM's announcement of the 4300 (E Series) set new price/performance standards, Itel found itself with sizeable inventory and declining margins on its computer business. Still worse, the rumored "H" Series loomed forbodingly. Thus Itel's PCM inventory didn't move as expected. Also, the 370 lease base was becoming harder to remarket. During the first half of 1979, Itel published a loss of over $50 million. As of June 30, its computer inventory was $120 million -- machines sitting on the shelf and not generating badly needed income.

Management shuffles and retrenchment were the way of life during the late summer. Layoffs were rampant, and a plant developing the "Hawk," intended to combat IBM's future line, was closed. An office of the president was formed, with Gary Friedman, formerly executive vice-president, John Redfield, president, Douglas Norby, senior vice-president, finance, and Tom Tan, vice-president and head of the container division. Excluded, Dick Lussier, executive vice-president, was one of the first top brass to depart. John Clark, then vice-president, stayed on holding down the fort, knowing a deal with National Semi was in the air. As might be expected, the only person untainted by computer experience emerged running the company -- Tom Tan. Not surprisingly, the firm's plan calls for regrouping behind its container and rail business, which it handled on an operating lease basis. Its portfolio includes some 160,000 containers, 17,000 piggyback freight cars, 11 ships, some aircraft and some data service bureaus. The latter are being sold off when the price is right. A rail car manufacturing facility was sold because, although in the transportation field, it was a start-up business with a low rate of return.

Itel may disappear soon from the computer industry's vocabulary, but whether it will be able to stay away from the lure of one of the country's fastest growing industries is questionable. Itel started without much capital, found an innovative way of leasing, and reaped in the millions. It could be similarly inclined in the future.

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As NAS sells Itel's inventory, these proceeds will be used to lower Itel's debt to National Semi, which is rumored to be in the neighborhood of $30 million.

NAS says customers are seeing continuity in the marketing and service force and the order flow is resuming.

The recent trend toward conglomeration in the industry merits some attention. Currently Memorex has rejected the bid from Storage Technology Corp. and asked Amdahl to up its ante, but EDP/IR wonders if perhaps at least STC was thinking in terms of a triumvirate. If an amalgamation on that scale, including two peripheral makers and a large mainframer, were to occur, why not go all the way and add semiconductor and small mainframe manufacturing lines, such as those belonging to National?

LLOYDS AND LESSORS -- HUSH HUSH TASK FOR ARBITRATION

Huddled somewhere in the womb of the First National Bank of Boston's ("pregnant duck") building is a group of industry cognoscenti that is pondering the resolution of lessors' claims against Lloyds, the prestigious London insurer that made its name in the shipping industry. The decision will have a sizeable impact on the health of the computer leasing industry.

From 1975 to 1978, Lloyds offered essentially to guarantee the value of systems on lease. The deal offered to insure lessors against losses they might incur resulting from the different returns of a system staying full term on lease and the amount the lessor would get if he had to market at inadequate rates a system returned early. Lloyds, bear in mind, was not accustomed to dealing with an industry driven by technological changes wherein an innovation can cause significant price/performance improvements. When IBM announced the 4300, and repriced its 370 line, the lessors began entering claims against Lloyds estimated in the millions. And it's likely more claims will be submitted. The group deciding these claims is comprised of third parties. A decision was expected by the end of last month.

Intel follows technology to new markets

Intel, meantime, is growing its own products oriented to specific markets by applying its technology to tackle the consistent bugaboos in the industry such as software.

James Lally, general manager of development systems operations of the microcomputer division, explained the microcomputer area is targeting solutions costing under $2,500 to unsophisticated customers. A microcomputer is defined as a combination of a microprocessor, memory and I/O that perform as a complete computer system. Intel also has a line of products called single board microcomputer systems, introduced in 1976. The capability/price ratio of these has improved 33 times compared with the initial 80/10 introduction three and a half years ago, he said. The capability has increased by a factor of 200 but the price has only risen by a factor of six, he said. The evolution of single board computers (SBC) will be at the same rate or faster than that of microprocessors, he said.

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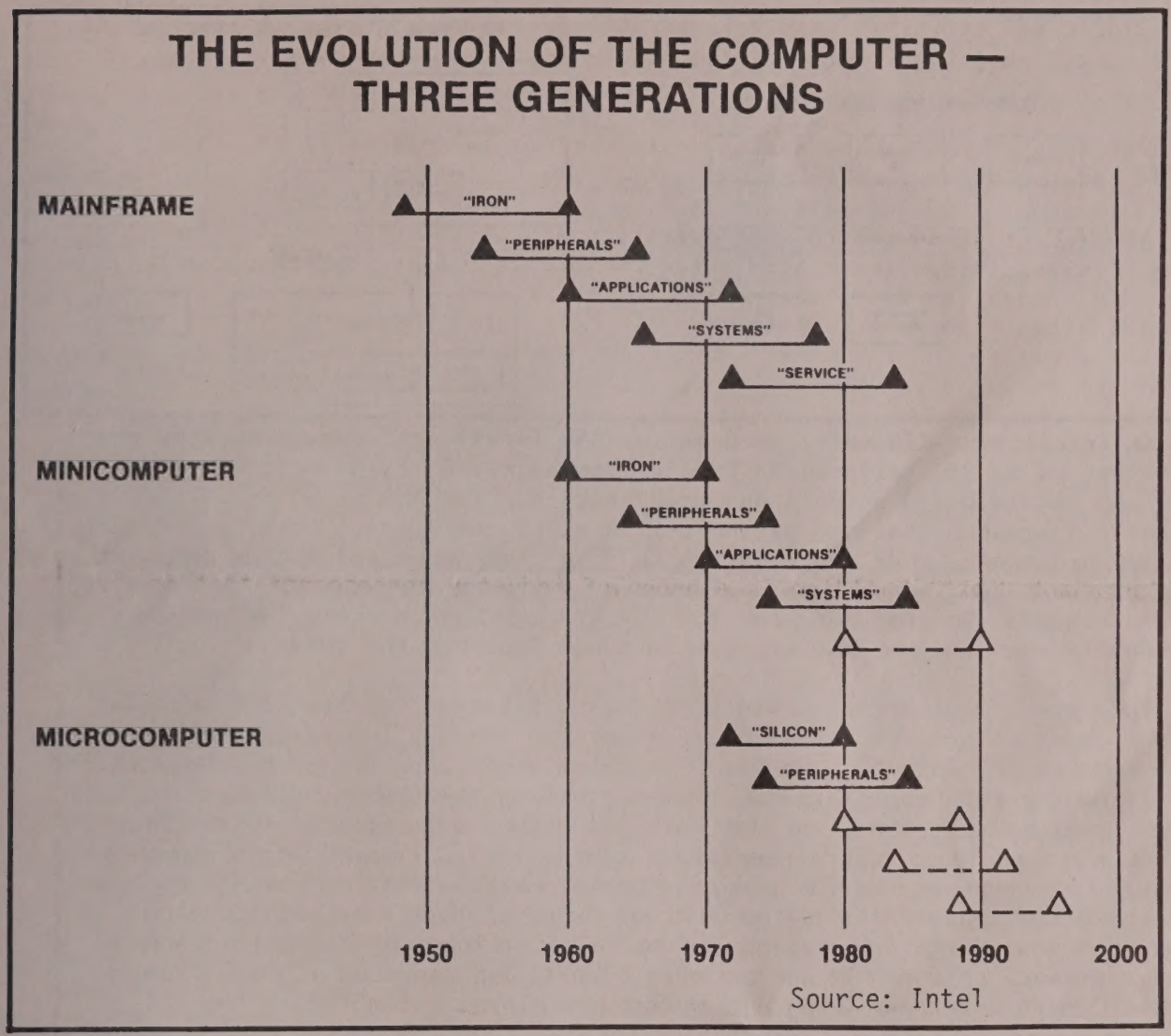

As can be seen from the above chart, the time span for any phase becomes shorter in each successive type of computer -- from more than 12 years for mainframes to less than 10 for the microcomputers.

In its SBCs, Intel has adopted several design and architectural philosophies to provide increased efficiencies and ease of programming. Among them are its use of:

- Dual bus architecture
- Intelligent input/output units
- Firmware for specific applications

Intel claims that bus architecture is the major difference between SBCs and traditional minis. The dual bus scheme dedicates resources to individual CPUs and the systems bus becomes a communication bus. The dual bus encourages modular solutions to problems, whereas the single bus encourages a unified solution, Lally commented.

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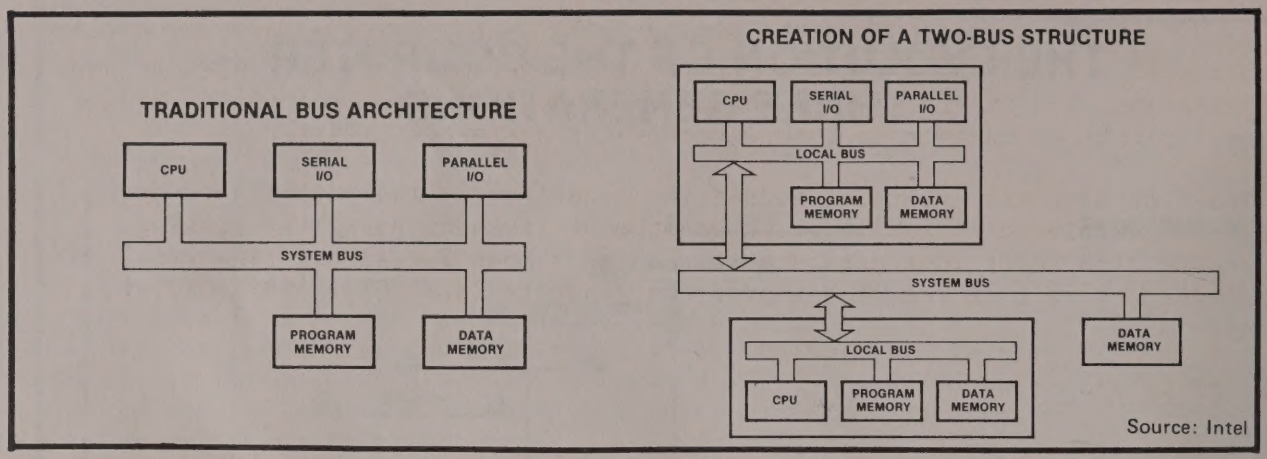

An intelligent I/O unit, such as the 544 intelligent communications controller, is an SBC tailored to handle communications tasks. It has 8K ROM and 16K RAM and is based on dual bus architecture. The 599 is an entire I/O processing subsystem that can serve four parallel computers. Intel claims use of an I/O processor (IOP) provides two to five times more processing bandwidth and at least doubles systems performance. With an IOP, the CPU is freed from I/O overhead. In addition, the IOP and CPU can handle executive programs concurrently, and the peripherals are on a bus local to the IOP.

This year Intel began providing firmware tailored for specific applications, such as the automation measurement and control industrial market. Look for more in the future. The 941 industrial digital processor has several preprogrammed common applications, thus offloading the CPU and eliminating much user programming. These include such operations as: stepper motor control, frequency counting, switch open/close sense, serial communicator, pulse generator, event sense and counting and period measurement. In addition, Intel designed the chassis for the market and is developing termination panels so that the real world can connect to the SBC in a way familiar to the users. For instance, this can be as basic as connecting copper wire with a screwdriver -- an interface a factory worker knows.

In short, Intel is finding itself increasingly acting like a minimaker, taking on the burdens of providing operating systems and nuclei for individual SBCs. Operating systems of the 8080 and 8085 now support high level languages such as Fortran and Basic. The 8086 now supports only PL/M and assembler, but it is fairly obvious high level languages will be added.

Tackling software with shortcuts

It is no secret that the cost of software -- both systems and applications -- has skyrocketed. The saving grace is that the cost of memory to accommodate programs written in high level languages has not skyrocketed. More and more, the tradeoff is memory to avoid programming in assembly language.

With the cost of supporting programmers skyrocketing, the logical way to go is high level language. Intel figures the 1980 cost of $450,000 for 13,000 lines of assembly language can be reduced to $100,000 for 3,000 lines of high level language that will accomplish the same tasks.

Intel has taken some steps with its 8086 processor's internal architecture to create a cost effective environment for high level languages. A register

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to memory symmetry, under which compilers store variables in memory, is a recognition that computers are not the place for programmers to play with assembly language, but that compilers should be generating code, according to Dave House, operations manager of the microcomputer component division.

The 8086 also has extensive addressing modes: array manipulation is base, index and displacement, while stack management includes parameter passing. There are also short instruction versions for common functions. The result of these changes is that the object programs generated are 30% to 50% smaller, Intel claims.

Fast growing acorns

The now-ubiquitous microprocessor began existence in 1971 -- and has grown from an average of 20 TTL elements to nearly 100K component/chip. An 8086 has computing power in the range of a PDP 11/45, so a multiple processor system is in the range of a mid size IBM machine. In seven years, the instruction speed has been improved by more than a factor of 10, according to George Schneer, general manager of the special products division. The day of the 16 bit microprocessor is here, and the likely trend will be to provide specialized co processors such as math and string processors.

The microprocessor's architectural ramifications are becoming evident throughout the industry. On mainframes, there is a definite trend to distribute intelligence throughout the system.

Microprocessors initially (1973-75) found uses in elementary processor support tasks such as clock drivers or "TTL glue," but now are found also as controllers, communications aids, and slave or specialized processors. In 1976-77 they became known for their functional enhancements, such as direct memory access for processors and expanded into roles as controllers. In the 1978-79 timeframe, they extended their roles to include I/O subsystems and now act as bus arbiters for processor support, all types of specialized controllers for peripherals, communications controllers of the SDLC type as well as specialized and slave processors.

However, progress has not been without cost. In 1973 it took two mask designers to create the 8080, in 1978 there were eight working on the 8086, and Intel estimates it will take 12 in 1979. In 1978 Intel spent more than $100 million on capital spending, more than in the previous four years combined.

SINGLE BOARD MICROCOMPUTERS

	1976 80/10	1977 80/20	1978 80/30	1979 86/12
CPU	8080	8080 8041	8085	8086
RAM	1K	4K	16K	64K
ROM	4K	8K	8K	32K

Source: Intel

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• WHEN IBM SNEEZES, IS THERE ENOUGH Kleenex for the rest of the industry? With IBM out in the market buying up 16K RAMs at a rapid rate so it can ship the 4341 out the door, there's good question whether the Giant's giant orders are drying up the supply for others. Recent testimony in U.S. vs. IBM indicates in 1979 IBM will buy between 200K and 400K of 16K chips and in 1980, when shipments of the 4300s are scheduled in volume, IBM has ordered some four or five million chips. The 1979 price indicated is between $8 and $9 a chip. IBM says it underestimated demand for the 64K chip.

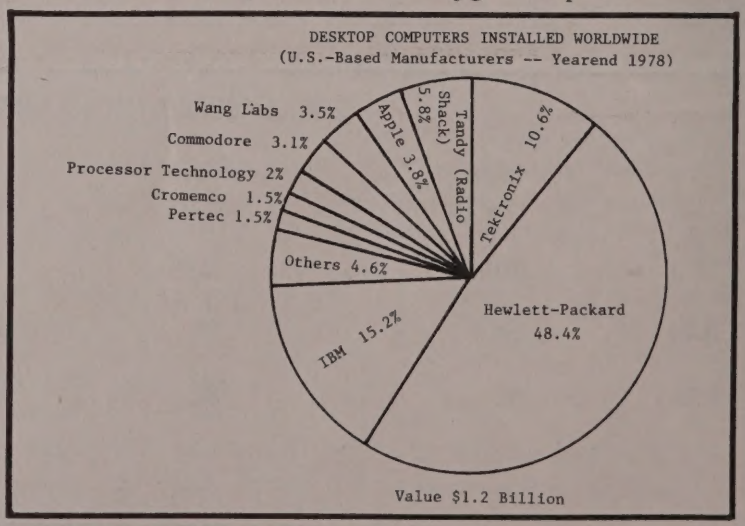
• MID-LIFE KICKER FOR 30 SERIES SIGNALS POSTPONEMENT OF H SERIES. Given the trouble meeting demand for 64K chips and yield problems with logic chips of the "Purdue" variety, IBM seems to have decided to focus attention on the 30 series -- via 20% purchase price cuts on the 3031 and 3032 and 15% on the 3033, as well as 33% cut on memory prices. Fitting into the new price curve are two upgradeable 3033 "Newport" models in 4M and 8M versions said to be 1.3 to 1.8 times as powerful as the 3032. Deliveries start first quarter '80 but upgrades are not until 1981. The N-4 is priced at $1.8 million with a $55K/mo lease under four year terms. The N-8 costs $2.4 million or $83,235/mo.

• BIGGER IS BETTER THEORY -- Datapoint raised the memory capacity of is 6600 and 6000 series processors to a maximum of 256K. Users can have twice the available memory as previously -- 248K. The bigger6600 can support up to 24 CRTs. Upgrade kits are available to users with 120K for $3,200. T/S Datashare software now provides larger user programs -- 63.5K bytes --, and handles all Datapoint processors. There's also a print spooling feature and more communications facilities. Microdata has a "performance enhanced processor" in the Series 8000 for 20% to 30% faster speeds; maximum memory is 512K.

• BURROUGHS WOOS DISTRIBUTED DATA PROCESSING mart with its latest addition to the 900 family -- the B 1900 series of small to mid-range systems. The three models range from entry level to a dual processor, with prices starting at $71,500 for the basic unit and a $7,500 one-time software fee to $148,960 and $18K for the top of the line. The systems boast 30% better performance than the current Burroughs models in this class. Cobol is quoted as 50% faster, Fortran up to three times faster than with previous compilers. Courting both the high and low ends, data base software is compatible with its larger systems and Computer Management System software provides an upgrade path.

Corrections

The text accompanying charts on personal computers (EDP/IR Oct. 23) refers to the U.S. market. Here is the corrected version of the installed worldwide base by value, year end 1978, with the total being $1.2 billion.



Honeywell says its 8/70 MP is the only machine in the 8 family that can be tightly coupled i.e. share one copy of the OS.

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"THE GRAY SHEET" NOVEMBER 16, 1979 • VOL.15,NO.11 P.J. McGOVERN,PUBLISHER

IBM Tells Wang to Move Over

5520 -- IBM'S ELECTRONIC MAIL BID FROM GSD DESIGNED FOR USE WITHOUT A HOST

All three divisions of IBM have pounced on the word processing (WP) arena but with different approaches. The 5520 "Administrative System" from GSD represents IBM's first full-blown effort to address electronic mail. It's also the first IBM WP system to bear the term "shared logic." Naturally enough, the 5520 embodies GSD's philosophy of systems that operate independently of a host. Although the 5520 will connect to 370s, it's self-sufficient in communications and word processing.

Where does the 5520 fit? It's a fairly capable electronic mail system, complete with document distribution and file/retrieval capabilities. EDP/IR thinks it will make a good partner to the 6670 "Information Distributor" from the Office Products Division. Announced in February 1979, the 6670 has a laser printer and communications capabilities. But its editing capabilities are nearly nil -- one has to send information back out to a 6240 communicating mag card typewriter for revisions. Enter the 5520, which also has communications, links to the 6670, and is designed to handle WP functions.

The 5520 will more than likely make its mark in both the document distribution and word processing arenas. One IBM watcher expects IBM to ship between 7,000 and 8,000 systems with an average of six workstations by the end of 1982. And deliveries of the system with electronic mail capability don't start until November, 1980. The system hardware is priced in the ballpark of shared logic devices, with keystation prices ranging from $11.7K to $12.9K -- and the 6240 mag card units can also serve as keystations. But software, which includes both WP and document distribution, leases for $245/mo.

It looks like a frontal attack on Wang, which in 1978 had garnered 44% of the installed worldwide base of clustered systems (by number of keystations). So, while in its WP context, the 5520 is another instance of IBM waiting to see how the market patterns and demands develop. But its document distribution features may well blaze the path for others.

Not surprisingly, one of the fastest growing areas in WP is that of communicating word processors -- IDC projects U.S. shipment numbers will just about double every year from 1978 through 1984.

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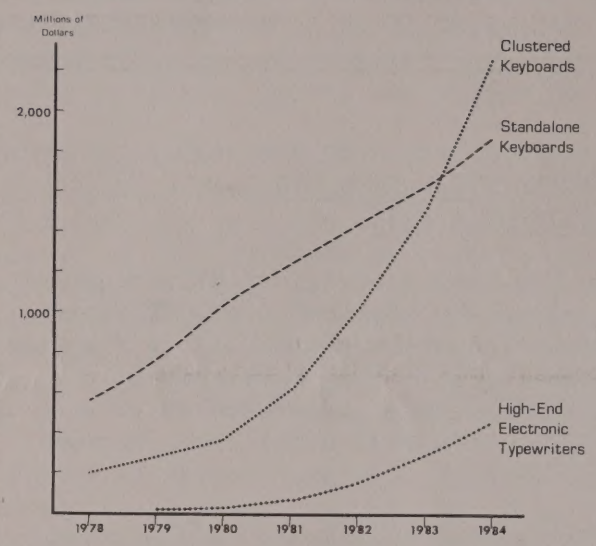
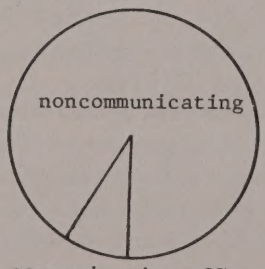
$ VALUE OF U.S. WORD PROCESSING KEYBOARD SHIPMENTS



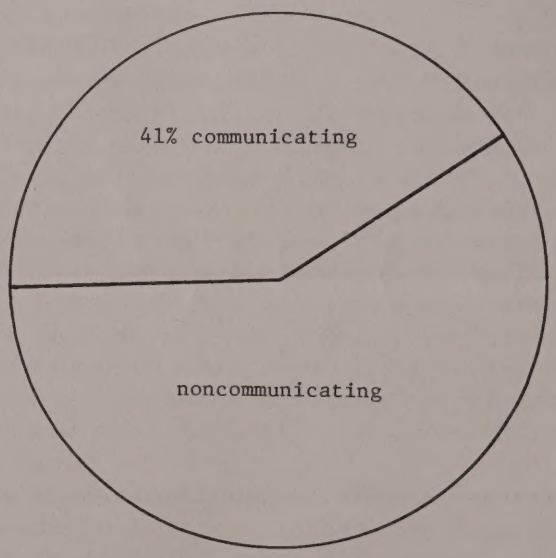
IDC expects the dollar value of U.S. word processing shipments to grow at a compound rate of over 30% from 1978-1984. Stand alone shipments will rise 22% a year, clustered systems 50%, and high-end electronic typewriters 124%.

Note: The average number of keyboards in an installed clustered system should rise from four to seven and the dollar value of clustered keystations shipped will rise from $13.7K to $15K as vendors include more capabilities. The IDC forecasts for clustered keyboards exclude distributed data processing or small business systems with WP software unless the systems are being actively promoted as WP systems by the vendor, such as Four Phase, Datapoint and Mohawk Data Sciences.

U.S. COMMUNICATING WORD PROCESSING KEYBOARD SHIPMENTS



1978 - 55,000



1984 - 415,000

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Different versions of game

A look at word processing related products emerging from the three IBM divisions gives some idea of their philosophies. GSD and OPD appear to favor systems operating independently of a host while Data Processing Division (DPD) likes linking systems to its hosts. (Without hosts, where would DPD be?)

Announce Date	Division	Product	Description
11/79	GSD	5520	Electronic Mail/Word Processing System
2/79	OPD	6670	Laser Printer with Communications
10/78	DPD	3730	New 3791 controller handles DP and WP concurrently, designed for 370 attachment but can be standalone
1/77	OPD	OS/6	Word processor - multi-stations, not much communications
6/76	GSD	WP/32	WP on 32 single-station

System Characteristics	5520	6670	3730	OS/6	32 WP
Purchase ($K)	64-175	75	43-55*	9-27	38,380 **
Disk (Min-Max MB)	29-130		5.5-24.1	?	5-13.7
Diskette	1-23MB	1 nonrem.		1,274KB	1,274KB
Printer (cps)	55, 92	36 page/m	55	55, 92	92
Comm with:					
5520	x	x		x	x
6670	x	x		x	x
3730			x		
OS/6	x			?	
32 WP	x	x			
Sys/3		x			
34		x			
370	x	x	x		
6240	x			x	x
Mag II				x	x
Comm					
3420					x

* System with 3791 controller, one 3732 display and one 3636 (55 cps) printer.

** Basic system with 50 lpm printer and 3.2M disk.

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Capabilities

The 5520 has some interesting innards about which IBM isn't saying much. It has fairly extensive networking capabilities, including the ability to route around a node that is inoperative and to notify that node of its inability to receive a message. Users can address individuals at their correct terminals by using a master directory in the system.

Capabilities include the usual raft of word processing-type editing functions, including a menu approach, in addition to such goodies as background processing to handle pagination, printing, global replacements and archive/retrieve functions.

There are four models, each with two or more processor units, and hard disk capacity ranges from 29M to 130M bytes -- piccolo 8-inch disks -- in addition to the use of double-density, double-sided 4M byte floppies. Communication capabilities include bisynch, SDLC and transmission via switched lines at 4,800 bit/sec or nonswitched up to 9,600 bit/sec.

For local connection, IBM has devised a "twinax" cable that stretches nearly a mile (5,000 feet) in either direction from the 5520 processor. But although it talks the IBM communications lingo, one cannot add other IBM terminals without doing some programming.

The first model to be shipped is a text-only version of the 20 starting in February. It can be upgraded to include electronic mail in November, when that software and the other hardware is scheduled to be shipped. Software, whether WP or WP/electronic mail, costs $245/mo. The smallest, text-only system, the 20, with 29MB, five 5253 displays, and two 5257 printers costs $64,351 or $1,980/mo. The 50 -- with 130M, 15 of the 5253s, six 5257 printers and sup- port for four communications lines -- is priced at $175,753 or $5,372/mo.

Here's how IBM describes the four models.

Model	020	020*	030*	040*	050*
Disk Storage Capacity	29 MB	29 MB	29 MB	65 MB	130 MB
Attachable Display Stations	1-6	1-6	1-12	1-18	1-18
Online Diskette Capacity	1 MB	1 MB	1 MB	1 MB	23 MB
Attachable Printers	0-3	0-3	0-6	0-10	0-12
Printer/Commun. Lines	0-1 (printer only)	0-2	0-4	0-8	0-16
Mag Card Unit	0	0-1	0-1	0-1	0-1

*scheduled for November 1980.

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WP from all sides

As it becomes increasingly apparent that the way to the big market lies in making systems approachable, DP vendors are looking at the word processing arena as an example of how to make systems usable and popular with non DP people. In addition, many of them are openly courting the word processing market per se.

Thus the recent rash of minis and small business systems offering WP packages. These systems that offer both DP and WP capabilities are called hybrid systems. The approaches and successes will vary immensely. Wang, for instance, puts most of the intelligence in the individual terminals, thus avoiding performance degradation as terminals are added. Most of the DPers' terminals share the CPUs' logic. In both cases, the peripherals are shared by the various keystations. IDC uses the term clustered keystations to encompass both types of arrangements.

Some of the vendors with hybrid systems include: IBM with the WP/32, Four-Phase, Datapoint, Mohawk Data Sciences, Digital Equipment Corp., Basic Four, and Wang.

(Data General just joined the ranks by putting its Aztext package on its Eclipse systems. However, it's not available on DG's smaller systems yet, and response time isn't as good as with a system dedicated to WP, like a Wang is.)

Electronic mail

While the 5520 and the Office Information System (OIS) from Wang may ride the crest of today's technology in terms of document distribution, think about tomorrow, when Satellite Business Systems and others such as Xerox's XTEN provide really broadband and rapid communications. New end point devices will surely ensue. SBS is busily stirring up other vendors to invent for tomorrow's realities, for instance, AM International is working on a prototype unit that will transmit documents at the rate of 10 pages/sec. And there's also lots of work being done to expedite facsimile.

Today, electronic mail has many different versions, but the definition that encompasses most versions is moving non-voice messages by electronic means rather than physical distribution of documents. This includes Telex, TWX, facsimile, computer-based message systems and communicating word processors but excludes such things as Mailgrams, which need physical distribution to the ultimate recipient. The varieties of electronic mail are:

- Electronic mailbox
- Document distribution
- Filing and retrieval capabilities

The electronic mailbox concept at its simplest consists of messages sent to a particular terminal. The recipient can have the message printed. After receipt, the message is deleted from his file. Document distribution involves sending pages of text (and sometimes graphics) to different locations, where they are recreated via a (preferably high-speed) printer/copier mechanism. The third aspect provides electronic filing and retrieval capability.

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Most electronic mail services -- a logical move for time-sharing firms -- are "mailbox" type systems. Examples are Comet, from Computer Corporation of America, also available as a software package, Infoplex from Compuserve Inc., and Ontime from Tymnet.

There are very few systems specifically addressing this market that are sold as hardware -- IBM and Wang come to mind. Perhaps this is because the electronic mail market has come and gone as a buzzword -- conceptually anyone with a terminal should be able to communicate with anyone else a la the woebegotten, postponed Advanced Communications Service (ACS) from AT&T. (EDP/IR can well-understand the software development problems AT&T is having with the utopian ACS. Ma Bell has written herself a tall order. What's puzzling is AT&T's latest announcement of delay, not only for software reasons, but to wait for new state-of-the-art developments in hardware. Which Ones?)

But until the age of idealism comes, there is a vast market ready to be tapped by those who can either glue together installed gear or sell hardware with their software, as IBM's GSD is trying to do.

Wang vs IBM

The 5520 appears to be capable in the three aspects of electronic mail. The question is how does it stack up against Wang? Wang, which churned out 1,900 workstations/mo in its recent first quarter, has announced its Mailway system for delivery in February, 1980, thus beating IBM to the marketplace. But the Mailway requires a VS system to act as a traffic cop, thus burdening a VS with some overhead. A small VS system sells for $70K. Wang is investigating the feasibility of putting Mailway on an OIS without a VS. Another important difference is that filing and retrieval capabilities have not been announced on Mailway.

The pricing philosophies differ as well as the concept of whether a central node is needed. Wang sells its software with a one-time license charge of $2K per VS system. IBM doesn't need a central CPU, but one has to have a 5520 in each physically separate location -- at $28.8K to $61K per CPU. IBM also licenses the software on a monthly basis, which can add up rapidly -- $245/mo is $2,940/year or $8,820 over three years, IBM's normal lease for the 5520.

5520 future?

For a document distribution system, the 5520 happens to lack a high-speed printer -- enter the 6670. The printers are 55- and 92-char/sec -- daisy wheel and ink jet. Interestingly, the price of this version of the ink jet is somewhat less than the others -- the 5258 costs $18,000 or $550/mo.

EDP/IR anticipates add-ons in the future -- either to this or similar systems. The 5520 lacks:

- facsimile capability
- OCR, DP
- Compatibility with 4300s, 8100s, other IBM terminals
- Printer for drafts.

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The 5520 is an interesting assortment of existing products -- or some variation thereof -- showing what IBM can do when it decides to pursue a market. There is little new except whatever is in the central processors. The terminals are reworked versions of those available on the System/34 with either 1,920 or 960 characters. The printers have been around, and the diskette magazine available on the 50 and the 8-inch disks have all made their entry in GSD products.

To market, to market

When one thinks of IBM, one thinks of marketing. In this case, GSD has put together a combined sales force of GSD and OPD people -- apparently OPDers were given the option of handling the 5520. The system itself comes from Austin, where there are three units of IBM, including GSD, OPD, and a technology group. GSD has site responsibility, but contends that means only that it pays the light bills. But a while back, there was indeed a transfer of some people from OPD to GSD because the product was more computer-related than office-related. Is the 5520 that particular product?

This product may go like gangbusters. And GSD could use a boost after its black eye from delays on the System/38. The 5520 could be the precursor of even more sophisticated communications software from GSD.

Will DPD sit back and watch? Perhaps. Granted, the clean line between small and large systems has gotten unbelievably fuzzy and granted the DP world seems to cope with multiple IBMs. But there are some things about the WP related mart that Armonk should bear in mind before it really jumps into the pond already occupied by its two brothers. Products going into office environments require a different orientation from DP products, despite the fact that eventually the DP and WP responsibilities may be borne by a DP person. Too many players wearing IBM hats could create sufficient confusion among buyers that -- horror of horrors -- they turn to Wang. Unless DPD commits heresy and provides systems that can operate without a 370 and that have a wide range of compatibility with IBM products from various sources, DPD could land in a mud puddle.

A talking typewriter?

Why not. In fact, it's here now from IBM. But the real question is when are we going to be able to dictate directly to the typewriter? The technology is coming, but unfortunately it is still simpler to create speech synthesis rather than the speech recognition.

IBM's Audio Typing Unit can be attached to any of four IBM magnetic media typewriters including the Mag Card II, Mag Card/A, memory or memory 100 typewriter and is designed to help blind typists be more self sufficient. By pushing any of 12 buttons, the typist can instruct the unit to read back lines or words from what has been stored on the magnetic media. In addition, the unit indicates operational parameters. A voice synthesizer unit produces and blends phonemes to form continuous speech in an unlimited vocabulary. Words are either pronounced as spelled, which indicates errors, or spelled out. In addition, the operator can turn off printing during document creation and revision and turn it on to produce final copy. The price is $5,300 purchase or $150/month under a two year lease plan. Deliveries for the Audio Typing Unit will begin first quarter, 1980.

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• AMDAHL RESPONDS IN KIND to IBM's price cuts on its 30 line and N models. As of March, 1980, there will be not only a 470V/7 and V/7A, but a V/7B, an entry level system to the V/7-V/8 series that can have the accelerator feature and can be upgraded to the other 7s or an 8. The 7B is about 60%-65% of the performance of the 7 with a price about 68% of the latest pricetag for a similarly configured 7. A 7B with 4MB, eight channels costs $1.45 million and can be upgraded to 8MB, 16 channels. Amdahl matched IBM's latest memory price of $50K/M byte and said its 470 prices reflect an approximate 20% cut for typical configurations.

• THIS WAS THE YEAR IBM WENT TO POPULACE -- for money. But was the objective of its recent $1 billion notes and debenture plan dollars or was it a combination of dollars and making the corporation more available to the small investor? As a result of IBM's four for one stock split, its stock prices are no longer in the stratosphere, but under $100 -- within reach of the small investor who wants a blue-blooded blue chip. The bond move seems another step in that direction, probably leading to the day when IBM enters the home computer mart and wants to conjure up an image of a company with which the consumer can identify. After all, it made an interesting deal for videodisk technology with MCA.

• THOSE SEARCHING FOR LOGICAL DATA BASE DESIGNS can get a roadmap in the form of "Data Designer" marketed by MSP Corp., Lexington, Mass. Because the package expedites the process of creating a logical data base, it is intended to encourage data base personnel to present their plans to end users for review before implementing the design. Data Designer presents a graphic depiction of elements in the data base, showing areas that could cause CPU degradation because of high secondary key activity and complexities that violate logical design principles such as third normal form -- wherein every attribute is dependent on the whole key and nothing but the key. Data Designer is a product of Data Base Design Corp., an offspring of DMW. One time license fee: $12K.

• MAKING PROGRAMMING EASIER was on Tandem's mind when it developed "Pathways," a transaction processing system intended to simplify development of transaction based applications by reducing development time in addressing terminal characteristics. Licenses cost $8,500 plus a $2,000 microcode charge for each processor. The first release is scheduled for February, 1980.

• BUTTING HEADS with the mid-range of DEC's line are the packaged micro based PDP-11V23 (floppy) and PDP-11T23 (hard) systems based on the 11/23. Software includes the RT-11 operating system and paraphernalia with Fortran IV and Basic. The T23 also runs under RSX-11M, and handles Basic-Plus-2, Fortran IV-Plus and PDP-11 Cobol. The systems have the full PDP 11/34 instruction set and are compatible with smaller micro's software. Prices start at $15,150 and $20,750 with shipments scheduled for spring, 1980. Typical systems are two floppy drives or two RL01 hard disks, 128K to 256K and a terminal.

• TYMSHARE PLAYS MUM ON PLANS FOR SYSTEM III -- a base it acquired from Lockheed. Tymshare says it acquired the System III lease and maintenance business and will integrate it with its Valcomp third party maintenance operation. There are 440 IIIs installed in the U.S., and many users are probably ready for an upgrade. Tymshare may be talking with mini makers to supply in-house machines and planning to ease the III base into its transaction business.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" NOVEMBER 30, 1979 • VOL.15,NO.12 P.J.McGOVERN,PUBLISHER

3033 USERS AWAIT DISK AS IBM MAKES CHANGES TO CHANNEL DIRECTORS

IBM's 3033 users are eagerly awaiting Santa after encountering hordes of elves who are making massive engineering changes to their 3033s' channel directors. Although in no instance has an IBMer indicated that these changes will specifically boost the data transfer rate that a 3033 can handle, users hope/expect that these changes are being done in preparation for an announcement that they too can have at least the 3370 disk announced with the 4300 series. Large IBM users haven't had a new disk from IBM since the 3350 in 1975. But IBM calls the changes routine, designed to improve maintenance and reliability.

While several DP managers interviewed by EDP/IR are somewhat casual about the changes, one has tallied the total number of hours of machine time required in the last quarter -- 108 hours. And, he opined, it seems odd that there were very few changes between last spring and this fall. Rather than present the DP director with a total overview of the changes IBM wants to make, IBM presents the package to him in bits and pieces. One DP manager said he never would have agreed to let IBM have the time on his machine had he known in advance how much would be necessary. However, he added, IBM has been very cooperative in getting its top technical people to install the changes.

Try as they might, these DP managers have not been able to discern either through reading the engineering changes or eliciting from the IBMers whether the changes will improve the data transfer rates. However, most suspect that this is the case, and anticipate they will also share in the wealth of disk technology that IBM has been bestowing on all but the large systems.

Another possibility is that IBM has up its sleeve a new mass storage device. One user got the strong hint from his IBM rep that he should delay obtaining a 3850. Why else other than that there is something new coming?

Just how big and how fast the new drive will be is still a good question. But the data rate of the 3370 disk exceeds the current capability of the 3033's channel director to handle it (each channel can handle 1.5M byte/sec whereas the 3370's rate is 1.8M byte/sec, which would leave the system with lots of overruns). EDP/IR suspects that the rate of the new disk (3390?) will

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exceed that of the 3370. By changing the arrangement of the dual actuators on the 3370, IBM could speed up the disk, which would make a larger disk probable. It is likely IBM will stick with the same technology used on the 3370 -- thin film head and oxide media. However, the 3370 did not approach the theoretical limits of this technology in terms of track/in., which could reach 1,500, according to the Memorex Recording Technology Center (EDP/IR, March 12).

With the disk may come additional improvements to the 3033 system. For instance, the fixed block architecture of the 3370, with data arranged in 512 byte blocks, relieves the user of assigning data to specific physical tracks. Also, IBM may advocate the hierarchical approach a la Memorex's device with a CCD cache. Bubbles like to work in multiples of 512.

Users seem to be turning to the 3880 storage controller announced with the 4300 (and available for the 30 Series) because of price advantage compared to their current 3830s -- basically a savings of 60% (one 3880 at $1,730/mo replaces two 3830s at $4,340/mo.) So IBM will not have a hard time selling the 3880 if it advocates its use along with the forthcoming disk product.

DTSS ADDS NEW WRINKLE TO MARKETING; SERVICES INDUSTRY GROWS 17%/YEAR

DTSS and its new owner, Metropolitan Life Insurance Co., apparently have concluded that the time-sharing business is no different from the hardware business -- the overhead is in the handholding of customers and marketing. Perhaps thinking that others can provide more tailored handholding, which is also one of the featured products of the services industry, DTSS has gone the route of distributors. It has applied the academic term (befitting DTSS origins) of "Associate."

The move is but the latest new wrinkle as services firms attempt to keep their growth rate at a pace that exceeds inflation. Some of the tacks taken:

- Offering inhouse computers
- Acquisition fever
- Venturing abroad, despite rumblings of regulations of what data can be transmitted internationally.
- Focusing more on applications for particular industries and markets.
- Eyeing the home infotainment market

Via its associate plan, DTSS intends to boost the volume of its business by courting such entities as:

- Companies now using service bureaus
- Consultants
- Application and system software houses
- Other service bureaus, such as batch shops.

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To implement its plan, DTSS is offering wholesale prices (50%), thus leaving the middleman or "associate" an operating margin that will encourage him to provide specialized services and some handholding/training of users. What does DTSS stand to gain? An influx of specialized programs running on its HIS 66/17, and users of these programs, which translates into increased volume.

Services picture

The overall services market, including batch, remote problem solving and autotransaction, is growing at an average of 17%/year through 1983, exceeding the 14% growth in recent years for staff-related DP budgets. And DTSS happens to be sitting in one of the fastest growing sectors of the processing services industry -- remote problem solving, also known as time-sharing. With a compound annual growth rate of 20% between 1978 and 1983, remote problem solving sector revenues will triple from $1.3 billion to nearly $3.3 billion, according to IDC figures.

Firms in the problem solving category now emphasize sophisticated applications in addition to sale of CPU time, whereas a few years ago the mainstay of this market was raw computer time. Looking at access methods of problem solving, revenues from the remote batch portion, while growing faster than those of the interactive sector, will not be equal in volume to interactive revenues by 1983. Problem solving is distinct from the other fast growing sector of the processing services industry, remote autotransaction. In this sector, specific applications are involved and the user is charged on the volume of transactions processed such as checks or invoices. In this area, remote batch revenues will exceed those of interactive access in 1980.

In 1979 for the first time, general business and administrative applications topped scientific and engineering applications as the largest application area for remote problem solving. The business and administrative revenues in this sector should exceed $600 million compared with $390 million in 1977. It's no coincidence that DTSS is targeting the business/administrative sector, emphasizing its interactive problem solving capabilities for use by those in management and other business-related functions.

The manufacturing market is large -- and a prime target of T/S firms -- with remote problem solving revenues growing from $280 million in 1977 to $390 million in 1979.

How DTSS associates plan works

Upon payment of a $10,000 associates fee, one receives $5,000 worth (at retail rates) of computer time for use in developing new applications, demonstration packages and getting ready to use the system.

Thereafter, time is available at 50% of the DTSS suggested retail rates with no minimum usage requirements.

Associates receive an option to obtain a license to all DTSS software for use on their own hardware. Those who license DTSS software receive credit for the first $5,000 of license fees.

DTSS provides a 2.5 day training seminar for management, marketing and technical personnel to prepare them to service end users.

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CHANGING SEGMENTATION OF PROCESSING
SERVICES MARKET
1971 - 1983
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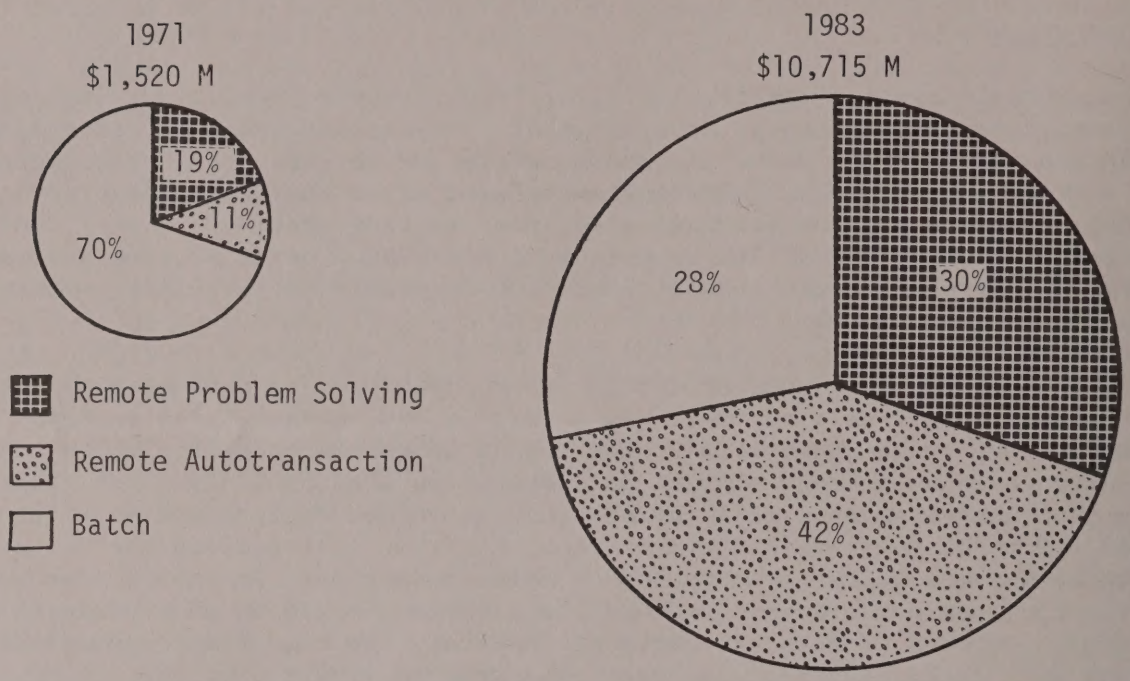
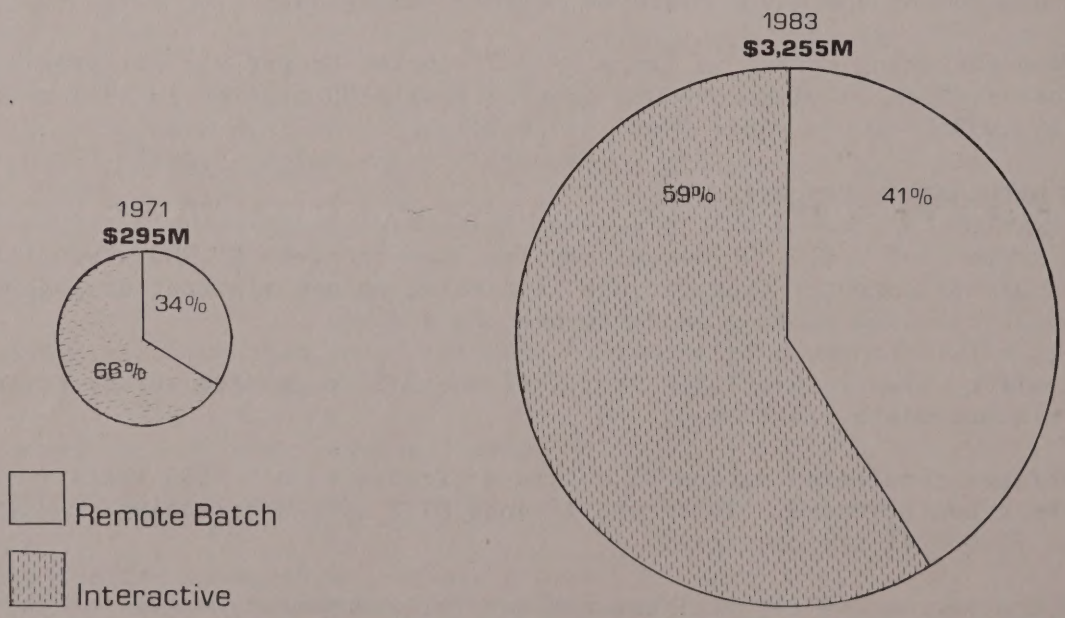


Changing Segmentation of Remote Problem-Solving Services Market
1971-1983



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An associates group organizes discussions on progress and problems a also acts as an exchange vehicle for members' software on a royalty fee basis.

The appeal of DTSS is not limited to Honeywell afficionados. One can tie in via Telenet, and DTSS has Datalink, which allows DTSS users to transfer files between DTSS and such systems as IBM 360/370. DTSS also has a relational data base and English type query language designed for ease of use.

Others watching

Thus far, other companies are watching the DTSS approach in this arena. But if the associates indeed perform the handholding rather than DTSS, the wholesale offer could boost earnings at DTSS.

Because remote problem solving is a "selling/service game," with most new revenues coming from increased usage by existing customers rather than from new client sales, the climate demands constant interaction between vendor and client. Thus many firms have offices dispersed near their clients.

On the international front, the sector with the largest share of revenues from business abroad is remote problem solving. An IDC report pegs the two leading suppliers overseas as Control Data Corp. and General Electric. But foreign revenues for remote problem solving sector are less than one fifth of the total for 1979 -- $300 million vs. $1.6 billion.

How pie is sliced

In the remote problem solving sector, 23 suppliers garnered 85% of the revenues, and in 1979 for the first time a supplier, Control Data Corp., topped the $200 million revenue mark in this segment alone.

TOP TEN REMOTE PROBLEM SOLVING FIRMS
Calendar 1978
($ Millions)

	Remote Problem Solving	Remote Transaction Processing	Batch	Total
Control Data Corp.	$218	$45	$90	$353
General Electric	185			185
Computer Sciences Corp./ Infonet	83		6	89
United Computing Systems	72			72
Tymshare	70	25	40	135
McDonnell Douglas Automation	60	58		118
Automatic Data Processing	55	25	245	325
National CSS	52		6	58
University Computing Company	41	11		52
Optimum Systems Inc.	33	8	4	45

Acquisition mania

The services industry is perhaps one of the more active segments of the industry in the art of buying and selling one another. And companies are not

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always consistent. For instance, Itel decided the services segment looked like easy pickings, and started acquiring firms at a rapid rate. Many of these were batch operations targeting very specific industries. But the bloom was off the rose quickly, and now the units so recently acquired by Itel are once again on the block. A couple of years ago, the pattern appeared to be larger services firms expanding via gobbling up smaller companies -- ADP and Tymshare among those on the acquisition path. Now, all sorts of other industries want either an entree into the computer business via the services route or a complement for their other lines of business. Chase Manhattan bought Interactive Data Corp., McGraw Hill bought Data Resources Inc., Metropolitan Life Insurance has DTSS and Dun & Bradstreet bought NCSS. H & R Block, Inc. is talking of buying Compuserve.

Thus the climate has changed. Whereas before stability meant becoming a large fish in one's own pond, now services firms are wary of fishermen from other territories.

Indeed, there has been more acquisition activity in the services sector than any other in the industry, according to an IDC report on acquisitions. Of 80 acquisitions, the services sector accounted for 42.5%.

The hardware approach

Not to be ignored has been the recent flirting of services firms with hardware. But in reality, they're not really entering the hardware market, for what they are really selling is software -- one of their principal commodities. The approaches vary. Among the remote problem solving firms, most of the systems tie in with the host system and network. Those in the remote autotransaction arena seem to have more stand alone systems, although they probably will eventually tie these in to their nets. The approaches listed below vary slightly as to whether one can purchase or lease the CPU and whether it can only be obtained as part of a service (ADP) but in general the thrust is the same.

Among the remote services firms offering hardware are:

- ADP with Onsite, a DEC 2020
- NCSS with its 3200 from Two-Pi
- GE's Marklink based on a Texas Instruments 990
- Manufacturing Data Systems, Inc. with its Compact II Series I and Series II that are turnkey systems for the numerical control market.

How important is this marketing tactic? Computer offerings represented almost 2% of the $1,330 million remote problem solving revenue in 1978 and will grow to 3.8% of the $3,255 million market by 1983. Because users of problem solving services are often functional departments within large corporations that have inhouse computers, many services firms are selling the distributed processing concept rather than approaching the DP manager directly.

Overall, the dollar impact of computers on services revenues is not great. The impact on the total market, including batch and remote problem solving and transaction, is about $155 million in 1978 and should grow to $460 million by

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1983, or from 3% to 4% of the total computer services market revenues. Computer offerings will have the largest impact on the batch sector, growing from 4% to 6% of its total revenues.

Electronic Data Systems Corp., Dallas, having boosted its small system expertise through the acquisition of Compusource Corp., is targeting the small business arena, initially the legal, CPA and wholesale/distribution industries. Plans call for the addition of medical and dental, property management and word processing systems. Planning a national distribution network, EDS is opening EDP Business Centers in four cities in addition to Texas.

The next link -- the home

The market nearly all services firms are looking at, but one in which very few are venturing, is the home. Tymnet made a luke-warm attempt to lure other firms selling to the home mart by offering a flat rate on its Leisure Tyme, service of $7,500 minimum monthly rate and 75 cents per connect hour. However, there have been no customers on that basis. In order to encourage off-hour use of its net, it also offers an overflow rate of $2 instead of $8 for those customers with at least 10 dedicated ports. And another firm, Compuserve, is wooing home users with off-peak rates to its facilities via Micronet. Announced last August, Micronet has 600 users.

One of the few services firms that are seriously courting the home mart is Telecomputing Corporation of America (TCA) in McLean, Va., which offers "The Source," a range of programs covering diverse fields from accounting to daily news, games, home management, shopping and electronic mail. Formed by the heads of Digital Broadcasting Corp. and Dialcom Time Sharing Corp. (which uses Tymnet), the Source itself uses Telenet and Tymnet.

TCA is offering franchises of retail outlets to provide sales and service, and also sells its service through other retailers. TCA provides the programs, which are designed for the uninitiated. Basically the franchiser peddles hardware, ranging in price from $595 to $1,895 and gets 40% of the $100 onetime registration fee as well as a slice of the user's payments for connect time, which are $2.75/hr in non-prime time (after 6 p.m. and weekends).

The first market TCA is courting is those with personal computers, such as TRS-80s -- anything that is RS-232 C (Teletype) compatible. Those users pay the $100 fee as well as usage rates. The next market is the commercial, which TCA expects to lure with its electronic mail offering as well as other features such as stock quotes, etc. The third market is those consumers who do not yet have personal computers.

The Source has almost 2,000 users -- not bad considering it was announced only last June. The majority of users already had personal computers. The most popular programs are finance, stocks, electronic mail and shopping.

While the service now is tied to phone lines and depends on interactive communication between the terminal and the central computers (Prime 750s), eventually TCA plans to offer software that will allow tht terminals to downline and upload specific programs and data, thus in effect creating a network of distributed processing units. EDP/IR suspects the home market will really begin to fly when there is cheap storage so users need not accumulate massive communications charges and connect-time fees. What about videodisks?

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• THEY'LL GO IT ALONE VS IBM. Another saga of would-be conglomeration of complementary plug compatible products has ended in default, with Memorex and Amdahl chief execs retiring to their individual campus-like provinces of Sunnyvale and Santa Clara. Perhaps another case of who couldn't agree who would be chief honcho, the unconsummated flirtation ended after Memorex, first courted by Amdahl, spurned Storage Technology Corp.'s higher ante and cuddled again with Amdahl. But no deal was forthcoming. Memorex says simply discussions were terminated. Perhaps the deal wasn't sweet enough for Bank of America, which still has Memorex beholden to it. Thus, what could have been at least a duet, if not a triumvirate, of forces facing IBM leaves each as a solo.

• PERTEC'S COURTSHIP -- HOTLY PURSUED BY FOREIGNERS -- and the winner is -- Triumph/Adler instead of North American Philips Corp. Volkswagenwerk, majority owner of T/A, has been buying its way into the information industry -- first T/A, and now Pertec. T/A picked up over 86% of Pertec common at $16.50/share and has extended the tender offer until Dec. 10. The action must have been fast and frantic. Oct. 10 Pertec said it had signed a definitive agreement with Philips, but Oct. 22 it had done the same with Triumph/Adler.

• MCI TAKES ITS TURN AT ANTITRUST BAT vs. Ma Bell. (Who Else?) MCI's antitrust case is scheduled to go to court December 3.

• IN THE NICK OF TIME -- AGAIN. IBM delivered its first 4341 in the fourth quarter, as promised, to Hughes Aircraft Co. in Newport Beach, which also took delivery of the first 3370 disk.

• IBM BUYING DATAPRODUCTS PRINTER assemblies. Seems the Giant is going out of house for everything from chips to subassemblies. Time was when Qume made news with its contract with IBM for daisy wheels. This contract is with Dataproducts' Santa Clara facility, which produces matrix printers.

• THERE WILL BE MORE TALK ABOUT TALKING products. Word has it there are TVs that respond to voice commands and answer "OK" if the command has been understood. Now Interstate Electronics Corp. offers a single-board voice recognition module starting at $1,525 as well as gear designed to facilitate integration of the unit into products such as intelligent terminals. The unit's protocol is compatible with high level languages. Vocabulary range is 40, 70 or 100 words. Not the $100 price tag some seek, but a step towards it.

• DG ECLIPSES GET MORE NETWORKING sophistication with the Xodiac Network Management System that's based on its Advanced Operating System (AOS) and X.25 protocol. Xodiac allows use of remote resources and also shuffling of files from one AOS system to another as well as transfer of data among DG computers. The first Xodiac node costs $8,500; others $4,100. Xodiac runs on Eclipses with at least 512K bytes.

• TRYING TO GET THE OVERHEAD DOWN, Tandy and Datapoint have combined on a joint manufacturing project to produce selected peripherals. One of the logical first products would appear to be floppies, as the aim is to serve in-house needs (presumably mutual needs). Datapoint currently is pretty well vertically integrated, but wants the economies of scale that come with volume. There should be volume with TRS-80s -- IDC estimates there will be 110,000 of the units installed by year end.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" DECEMBER 14, 1979 • VOL.15,NO.13 P.J.McGOVERN,PUBLISHER

Facsimile growth in hybrid systems -- Page 5

POS SYSTEMS FIGHTING OFF FLYING WEDGE OF ELECTRONIC CASH REGISTERS

With IBM landing an order from F.W. Woolworth for about $25 million worth of point of sale (POS) gear, it's time to examine that mart and the recent and forthcoming changes occuring. Once the retail world was simple -- it had cash registers. Then along came POS systems, which linked to a mini (generally on-site). These cost several thousand and thus were not apt to find their way onto the floors of Mom and Pop shops. But then the waters became muddied by the electronic cash register (ECR), made possible through the use of micro-processors. These come in two flavors -- the low end and the sophisticated -- and the dividing line between these two seems to be the $2,000 mark.

Some estimate that the high end POS gear can garner about one third of the total potential retail market, and low end ECRs just under half of the total mart. The remainder will probably fall to the sophisticated ECR that collects transaction data, communicates with other ECRs as well as hosts and probably sports some sort of industry orientation.

The implications of the changing equipment for retailers to both the industry and the public are numerous:

- Consumers are finding ECRs and POS gear nearly everywhere -- even the corner gas stations are part of the trend with light emitting diode displays and beeps instead of clangs.

- The retail areas representing strong potential growth for POS/ECR gear are fast food outlets, apparel and discount stores -- not necessarily those needing full-blown POS systems.

- With almost three dozen suppliers, there may well be some fallout in the market within the next five years as they face the additional need to adapt to new technology and markets with needs different from those of the POS folks.

Fallout is not a new phenomenon to vendors in this arena. Some of the past casualties include: Singer (industry leader at the time), Pitney Bowes, RCA, MSI Data Corp., Bunker Ramo, DG (acquired by Sweda), and Univac.

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WHERE ARE THE (U.S.) POINTS OF SALE?

Federal government statistics (in round numbers) indicate a massive market for POS and ECR vendors as product prices decline.

General merchandise	2,500	department stores
	3,400	Big Three retailer (Sears, Penney, Ward)
	7,500	discount stores
	36,000	variety stores
	150,000	apparel stores
Specialty Stores (including drug, liquor stores, service stations, others):	1,100,000	
Food Distribution	30,000	convenience stores
	33,000	supermarkets
	150,000	specialty food stores
Hospitality	61,000	hotels, motels, and private clubs
	91,000	beer and liquor stores
	432,000	food service establishments (including restaurants, fast food, schools, and institutions)

IBM order includes discounts

IBM landed the Woolworth order for at least 8,000 3680s after an evaluation by Woolworth that lasted more than a year. Others bidding on the giant pact were NCR, Sweda, Data Terminal Systems and TRW. Woolworth specified the number 8,000 because that is the amount the firm believes it can install in three years. However, the total award is believed to be larger.

Interestingly, IBM seems to be getting the hang of the volume discount. It quietly introduced a "volume procurement agreement" in July for its 3650 and 3680 retail systems and 3660 supermarket system. The Woolworth bid embodies a discount -- which can be between 4- to 8% if the customer handles more responsibility for store implementation, planning and set up.

Woolworth will get 6,000 of the 3683 terminal and 2,000 of the 3684 -- which combines the terminal and controller. Installations will start during the first quarter of 1980 into four Woolworth retail divisions: Woolco U.S.A. and various Woolworth stores; Richman Brothers and Anderson Little; Kinney Shoe and Susie Casuals; and J. Brannam. Currently Woolworth has an assortment of POS gear including terminals from Alpex, Singer and NCR. Some of the existing gear is expected to remain in place.

Loyalty hard to buy

Although this is IBM's largest POS order, it ranks behind NCR's $60 million order from J.C. Penney in 1974. But placement of a large POS order by a chain apparently does not preclude installation of another vendor's gear. For instance, last year IBM received an order from Penney for 6,000 of its older 3650 POS units. Thus vendors cannot necessarily relax their efforts for follow-on orders after booking a large contract.

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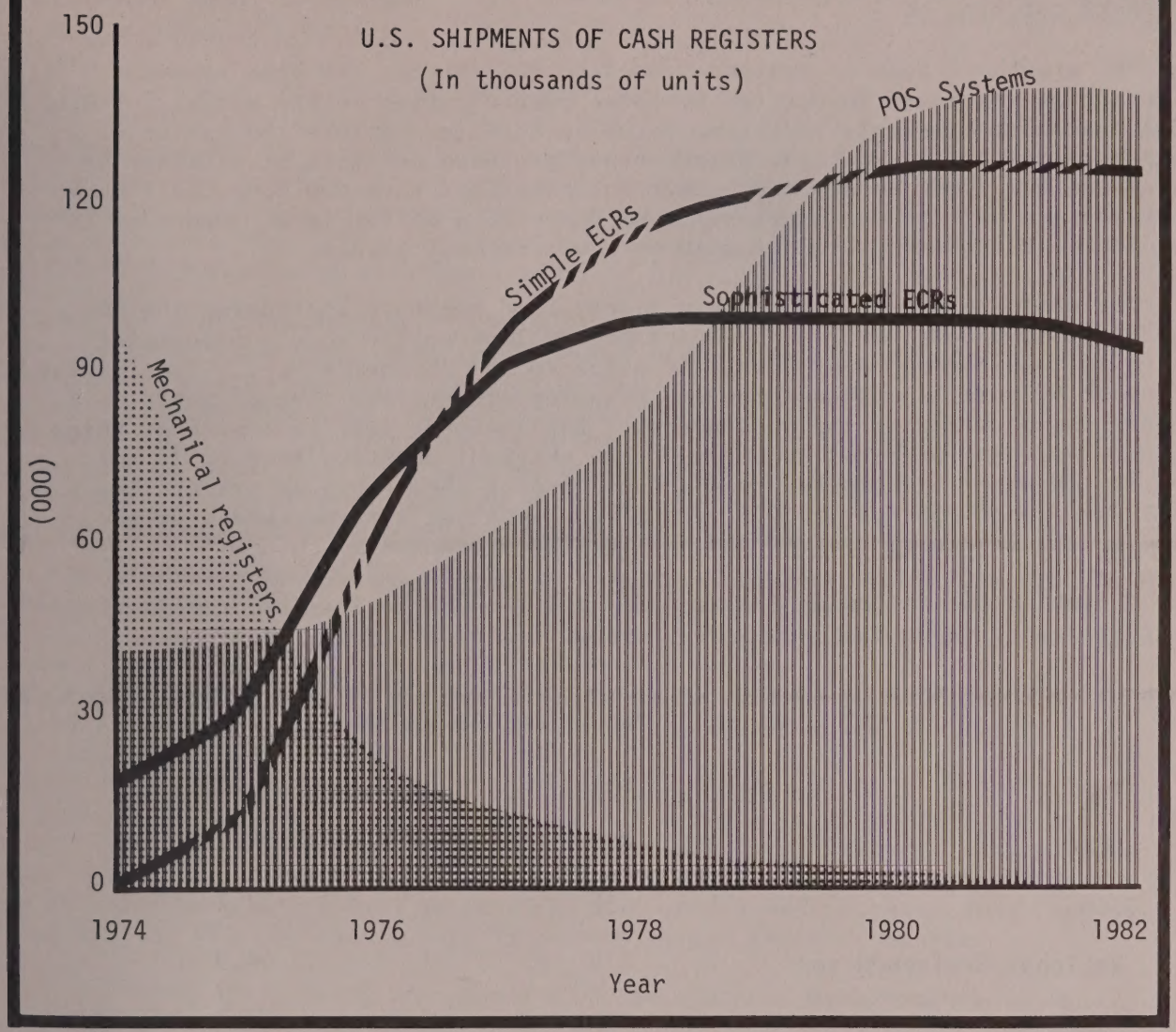
ECR VS. POS



WHO'S IN THE RANKS?

AMI Documentor Division
R.C. Allen
AMF Electrosystem Division
Anker Data Sales & Service
Cash Register Sales
Casio, Inc.
Check-A-Tron Corp.
Data Terminal Systems
Datatrol
Delta Systems
Digital Computer Controls
Fasfax Corp.
Gross Cash Registers
Hugin Cash Registers
ICL
IBM
ITT Courier
JAY Corp.
Kingtron Corp.
MKD Corp.
NCR
National Semiconductor Corp.
Norand Corp.
Sharp Electronics
Sweda International
TCA Inc.
TEC America
Tele-Cash, Inc.
Transaction Management
TransAmerica Computer
Tranti Systems
TRW
GI's Unitote/Regital
Victor Comptometer

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Scanners catching on

The growth of scanner systems linked to POS systems has been somewhat slower than initially forecasted by those participating in the market. Progress proceeded haltingly at first, catching headlines across the nation as consumers rallied against the practice and proposed practice of eliminating prices on the goods in supermarkets. But retailers have now done their homework and acknowledge that consumer confidence in a system is an important ingredient. Prices are still stamped on goods in most places.

The scanning systems, housing a laser, read the bars indicating the Universal Product Code (UPC) on the package and look up the code's associated price in the system and applies that price to the shopper's bill. The initial argument by retailers advocating the scanning systems was that it would save labor time of stamping the food prices. But shoppers felt that without being able to view the price of the item at the checkout counter, they could not monitor whether the computer system was charging them a higher price. The real savings of POS systems for retailers -- whether supermarkets or others -- come in the inventory control and back office procedures.

A look at the following figures from the Food Marketing Institute's third quarter report shows that scanners are now in a high growth period.

UPC SCANNING INSTALLATIONS BY VENDOR

Vendor	Number of Installations	% Market Share
NCR	461	38.5 %
IBM	452	37.7
National Semiconductor	179	14.9
Sweda	78	6.5
Data Terminal Systems	17	1.4
Sperry Univac/DataCash	12	1.0
TOTAL	1,199	100.0 %

SCANNING GROWTH OVER THE YEARS

YE 1974	6
YE 1975	42
YE 1976	104
YE 1977	206
YE 1978	562
1979 (3rd Qtr)	1,199

INSTALLATIONS BY TOP 10 RETAILERS

Winn-Dixie	129
Giant Food	117
Publix	63
Kroger	57
Ralphs	50
Safeway	29
Shaws	27
Schnuck Markets	25
Wegman's	24
Alpha Beta	23
TOTAL	544

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FACSIMILE'S STRENGTH AS PART OF MULTIPURPOSE SYSTEM

An often touted high growth technology, facsimile, is facing an ever narrowing window through which its market growth will occur. Basically it will soon become hard pressed by digital technology such as that embodied by communicating word processors and more elaborate computer based message systems. However, fax does have a lower equipment cost and thus will continue to serve in stand alone capacities for those offices where volume and need don't call for transmittal of keyboarded information.

But fax is far from dead. In fact, it is likely to shine as one of the elements in an electronic mail system. For instance, it could be part of a multipurpose system, such as could occur with the intelligent copiers of the future. Consider the broad band transmission capabilities that will be available with Satellite Business Systems (SBS) and Xten, among others, and one can anticipate machines that will receive and transmit documents at very high speeds via fax technology. And the receiving mechanism could be an integral part of a high speed printer/copier such as the IBM 3800.

Facsimile can be defined as a method by which alphanumeric or graphic information, either printed or handwritten, is captured from an original document and electronically transmitted to a remote location where a copy or "facsimile" of the original document is reproduced. There are four elements: input (scanning); signal processing (control electronics); signal conditioning (modem); and output (recording). Facsimile transmission was invented by a Scottish clockmaker, Alexander Bain in 1842.

One of the advantages of fax also is a disadvantage. For instance it doesn't require keyboarding, thus eliminating the possibility of errors in input. But with the growth of WP systems, printing out a document before sending it via fax may represent an extra step compared with transmission from one WP to another WP. However, there are other points in favor of fax:

- Implementation costs are relatively low compared with communicating WP and message systems.

- The error rate is low compared with digital schemes wherein a single bit line induced error changes the character transmitted. In fax, a character is represented by several scanning lines; a missing or changed pulse would still leave the character recognizeable. Also, eliminating the need for rekeyboarding adds to the error immunity as there isn't a chance for typist error.

- Compatibility among fax machines is getting better -- and although no paragon of virtue, it is better than between various types of word processors. Some of the problems occur with different modulations -- AM or FM; different phasing and synchronizing schemes can make machines with the same modulation incompatible; and some units cannot communicate with those of different speeds.

- Fax units can handle graphics in addition to characters, thus lending an element of versatility not possessed by WP systems.

One of the principle obstacles to the advent of more high speed (1 minute or less) machines is the lack of a worldwide standard. The Consultative

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Committee on International Telegraph and Telephone (CCITT) is working on this matter, and some of the manufacturers can be seen in somewhat of a holding pattern until the standard is established. Until last summer when IBM proposed a compression scheme, the leading method for consideration was proposed by the Japanese. Because standards lag behind product introductions, fast machines may see a repeat of other classes -- incompatible devices.

Fax machines fall into three speed groups, although some of the more versatile can handle more than one speed. While the slower speeds use analog methods, some sub one minute machines use digital schemes. The groups are:

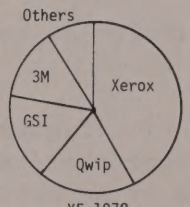
- Four to six minutes;
- Two to three minutes;
- Sub one minute.

Leasing practices mean 'cash cows'

Fax makers have been adhering to the practice of emphasizing lease over purchase of their machines. Over 90% of the installed base of fax units is rented. It looks like the strategy will pay off, especially for those with a large installed base of the low-speed machines on long term leases. Basically these will serve as "cash cows," continuing to generate revenue. Xerox recently with its fast 485 made purchase attractive, but that could mean that it wants to clear its inventory prior to the decision on standards for the sub-minute machines.

The market is highly concentrated among four vendors. Xerox, Qwip, GSI and 3M between them have over 90% of the installed base as of yearend 1978.

VENDORS' SHARES OF INSTALLED BASE -- YEAREND 1978



YE 1978
157,000

Middle speed, highest growth

IDC forecasts the highest growth in installed base will occur in the mid-speed devices, those in the 2- 3 minute range. These devices can be cost-justified at locations that could not justify the higher cost faster units, while the price difference between these and the slower units is recoverable through savings in communications costs.

The slower-speed devices, which form the bulk of the current base, will have a declining annual growth rate dipping below 5% by 1981. Their base will grow 43% from 1977 to 1984. The medium-speed devices will sustain annual growth rates in installed base ranging from over 100% in 1979 to nearly 28% in 1985. By 1985 the base of these units will be 14 times greater than it was in 1977. High-speed devices, starting from a smaller base, will see their

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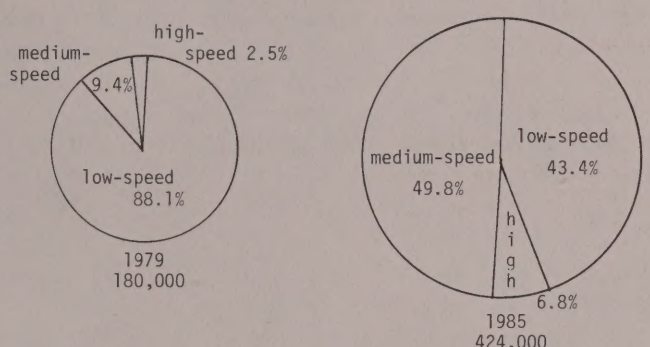
highest growth rate in 1980 of over 55% decline to 18% in 1985 and net a four fold growth in its base between 1977 and 1985.

High speed market small, competition great

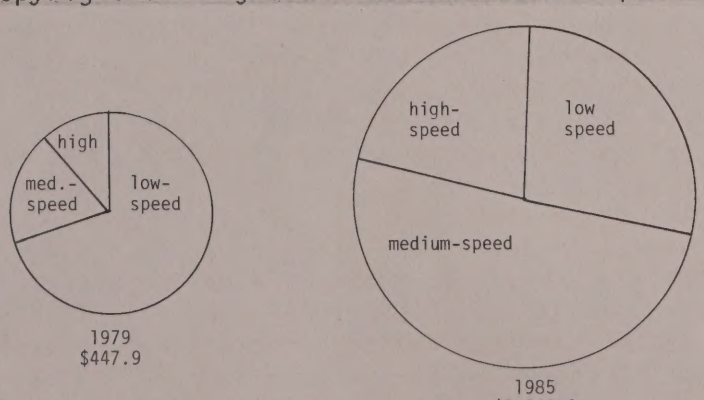
Based on its price projections of high speed fax units, IDC sees the high-speed digital fax market focused on few companies. The best prospects are the 600 large companies with 10,000 or more employees as well as some medium size companies -- for a total prospect pool of 900 to 1,200 companies. The small size of this market has led to the intense competition, and an IDC report predicts a shakeout. Briefly, IDC sees the high-speed devices declining about 15%/year in purchase price from $14K in 1980 to $6K in 1985, with the ratio of purchase price to rent/lease price declining slightly from 47 months to 36 months or $172. Growth in this area depends not only on whether these devices can reach the $150/mo price IDC sees as an inducement to market growth but more importantly on what other devices such as communicating word processors and electronic mail systems are offering.

However, Xerox with its 485 introduced last summer stepped forward with aggressive pricing of $6,500 purchase or $230/mo on a one year lease -- a purchase/lease ratio of 28 -- thereby making purchase attractive.

INSTALLED BASE OF BUSINESS FACSIMILE UNITS 1979 - 1985
(Copyright 1979 by International Data Corporation)



VALUE OF INSTALLED BASE OF BUSINESS FACSIMILE UNITS 1979 - 1985
($ Millions)
(Copyright 1979 by International Data Corporation)



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• DIDN'T TAKE NATIONAL SEMI LONG to learn to play the marketeering game with its new National Advanced Systems division. The new kid on the block, picking up Itel's old toys, has repriced the AS/7031, its own machine, at $600,000, 25% below the purchase price of IBM and instituted short-term leases of 18, 24 and 36 months, which are also below those of IBM. Memory costs $40K/M byte vs IBM's $50K/M byte, and the AS/7031 performance is said to be as much as 15% above that of the 3031.

• IBM ACTS AS SYSTEMS HOUSE with a special order from State Farm Mutual for a small computer system. Dubbed "Echo" by State Farm, the system is based on Series/1 architecture with 128K main memory, 13.9M disk, 256K diskette, serial printer and up to five display terminals. State Farm is doing the programming and all training will be self-contained within the system, requiring no out-of-office courses. The Echo will be available to an initial 200 agents in three states, with deliveries starting in 1980. After the shakedown, State Farm plans to lease an Echo to any of its 13,500 agents that wants one.

• PRICE OF LLOYD'S BATH RISES. Lloyd's of London, the venerable British insurer which built its muscle insuring ships, has increased the estimate of the loss on U.S. computer leases to $340 million, up from an initial figure of $234 million. Back in the days of the 370, Lloyds offered computer lessors insurance guaranteeing certain amounts of revenues from their lessees. But what Lloyd's didn't seem to take into account is the extent to which this industry's prices can be influenced by technology and IBM's pricing moves.

• ADR GETS OK TO SELL SOFTWARE TO USSR and Bulgaria, but only after some hefty amount of protesting -- even to Carter -- over the delays imposed. The City of Moscow and the Bulgarian Committee for the Unified System of Social Information have obtained ADR licenses to use various products such as The Librarian, Roscoe, Autoflow II and others. ADR filed its initial application for an export license back in April, 1978 and this fall protested the delay to Carter, citing that its products are not included in the restrictions on exports that "make a significant contribution to the military potential" of countries. The Defense Department had previously blocked ADR's petition.

• EVERYONE INTO THE FAMILY -- even AT&T? IBM-compatible is still the way to go for terminal makers, and also those with systems that wish to link to IBM hosts. Datapoint's EM3270 emulator package enables Datapoint systems to become linked with IBM hosts. The Datapoint 1571 dispersed processor looks like an IBM 3271 Mod 2 controller and its 3670 terminals look like IBM 3277s. The software license fee is $500. Teletype enhanced its 4540 terminal series with a protocol it says is equivalent to SDLC. The 4540 also supports 3270.

• TI CONTINUES BUBBLES with a board for the TM990 that has from 23K to 69K bytes of bubble storage and circuitry. Access time is 4 msec, data transfer rate 45K bit/sec. Prices range from $775 to $1,535.

• SANTA GETS HELP. Dayton's department stores, based in Minneapolis, enrolled a Northwestern Bell computer to gather and disseminate information about who wants what for Christmas. By touching a screen, a shopper can determine whether a person on his list has registered his wish list. A printout gives size and color preferences. More than 7,000 people registered with the system prior to Nov. 22; during the first five days of operation, over 15,000 customers used the system.

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"THE GRAY SHEET" DECEMBER 29, 1979 • VOL.15,NO.14,15 P.J.McGOVERN,PUBLISHER

Salute to Data Processing Managers

THE 70S -- DECADE OF THE DP SHOP; DPERS RIDE TECHNOLOGY CURVES, SURVIVE SUPPLIER SHIFTS

As the industry perches on the edge of a decade that many of us have been brought up to believe will be filled with the advent of the Dick Tracy watches and other once "far out" technological goodies -- to say nothing of the infamous year "1984" itself -- perhaps a look back at the 70s will put in perspective those hectic years during which "data processing" became passe and "information processing" became the buzzword.

The DP world has its own chronology of events, some that seem as bizarre as those in the rest of the world. But to fit things into perspective, cast a glance at the 70s in the rest of the world. It was a time when many of the "hippies" from the 60's free speech movement and antiwar rallies donned three piece business suits at computer industry conferences. There was a recession and another dip in the economy. Watergate taught everyone to suspect everyone else, especially those in authority.

More than anything else, the 70s provided the quintessential launching pad for this industry to move into the 80s -- perhaps analogous to the shakedown portion of a cruise into outer space. If one were to label decades -- (and just think, in 20 years we'll see a real, live new millenium) -- perhaps the following would fit the macro trend EDP/IR sees for information processing:

- 70s -- Decade of the DP shop;
- 80s -- Decade of the office;
- 90s -- Decade of the home.

Epitaph -- What can be said of the 70s, also the decade in which technology began to wend its way into the daily life of the masses -- via calculators, microprocessors in home appliances, autos, automatic teller and point of sale machines -- to say nothing of computer-generated bills? Epochal (because we were there); Apochryphal (some of the product announcements); Sad (pioneers still get shot by indians); Happy (when vendors created upgrades that weren't calamitous); Surprising (when semiconductor makers' learning curves became evident in improved price/performance hardware); Litigious.

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Through it all, the DP manager coped -- with slipped software deadlines, manufacturers' promises that didn't quite come true, and with attempts to make management understand DP could play a key role in decision making.

EDP/IR'S LIST OF 70S TRENDS

- 370 and virtual storage; 8100 and 4300 and distributed processing.
- Improved price/performance.
- Deregulation in the communications arena; AT&T's nose under the tent as a supplier of DP gear with the Dataspeed 40 et al.
- Satellites available for widespread use in communications.
- Packet switching with implications for compatibility between CPUs.
- Microprocessors, calculators bringing power to the people.
- Unbundling -- real or apparent?
  + Software as a market; shift to software as revenue source.
- IBM's reactions to independents
  + Lessors, PCMs -- memory, peripherals, CPUs.
- Minicomputer makers' provisions of useable software.
- Antitrust suits vs IBM : The hope Telex gave others.
- IBMs exclusion from the U.S. services industry.
- Increased user loyalty to their mainframe vendor.

IBM gave appearance of reacting

Perhaps the decade can be characterized as that time during which IBM presented the appearance of reacting to the marketplace. (Which is just how defense attorneys for IBM in antitrust cases have written the script.) Very few sectors have not had their turn in the barrel.

Bear in mind when reviewing the 70s that although in many instances IBM appeared to release its grips on something, very often it was simultaneously tightening its vices on another aspect of its product lines. (For example, IBM with the 4300s unbundled part of the operating system, but at the same time integrated the disk controller into the 4331. With the S/38, the data base management system comes as part of the operating system.)

Only just begun is IBM's move to reclaim some of the terminal market that independents handsomely carved out for themselves.

Coming in the 80s . . .

IBM's move to recapture revenues independents have been enjoying through applications software. Rumor has it IBM may be intending to sell its 4300s into new sites as "applications boxes" complete with applications software.

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AN ABBREVIATED CHRONOLOGY OF THE PAST DECADE

- 1970: 370; Computer Inquiry I ended; GE-Honeywell merger; IBM S/7; 3330; IBM into copiers.

- 1971: Exit RCA; data under voice communications announced; MCI operational; IBM's fixed term plan; Afips/Time survey: Americans feel computers affect their lives; Time-sharing thefts; Intel microprocessor.

- 1972: Controversy regarding IBM's limitations of amount of add-on memory; IBM announces virtual storage; Greyhound vs IBM dismissed; Telex files; Numerous user vs. vendor breach of contract suits; Independent peripherals becoming popular.

- 1973: Memorex exits CPU field, files suit vs. IBM; Pitney Bowes exits POS; Southern Pacific Communications Corp. plans nationwide network; General Automation makes false start with silicon on sapphire microprocessor; Federal Trade Commission orders Retail Credit to supply records to individuals concerned; IBM Winchester disk 3340; IBM SDLC protocol announced; AT&T unwraps Dataspeed 40.

- 1974: Energy crunch; Justice files antitrust suit vs AT&T; Floppy disk industry born; Privacy Act of 1974; Datran's network up; Court forces AT&T to interconnect with specialized common carriers.

- 1975: IBM says term "FS" Future Systems is dead; Telex decision overturned; IBM proposes Satellite Business Systems to begin in 1979; Telenet operational; U.S. vs. IBM begins in court; Xerox exits; Amdahl enters with 470 V/6.

- 1976: FCC okays Dataspeed (temporarily); Singer exits POS; distributed processing emerging; IBM unveils SNA, other mainframers their versions; HIS Level 6; IBM S/1; Datran files bankruptcy; Appellate court resurrects Greyhound vs. IBM; Itel markets PCM CPUs; Bell Bill scuttled, Congress to reexamine Communications Act of 1934; Court okays plan to eliminate need for Data Access Arrangements (DAAs) when hooking interconnect gear to public network.

- 1977: CDC, Hitachi in PCM field; IBM moves to protect 3270 mart; IBM gains directed verdict in Calcomp trial; CIA becomes Computer and Communications Industry Association (CCIA); IBM 3033; Small business computer mart heats up.

- 1978: Electronic mail begins to make inroads; HIS 66/85 killed; Digital communications finds new avenues; U.S. completes direct portion of U.S. vs. IBM; Encryption on a chip; Supermini PCMs; Proposed Communications Act of 1978 would override 1956 Consent Decree, thus allowing AT&T to be in DP; IBM okays peer coupling; 8100; AT&T proposes ACS; Word, data processing melding; Services firms offer hardware.

- 1979: IBM 4300; IBM buys 16K RAMs, drying up supply for others; Acquisition mania reaches feverish pitch -- services companies key targets -- many outside firms gaining entry to DP realm; Itel bows out of computer leasing, marketing; Integrated office systems are in; Personal computer makers target small business market.

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RECAP OF THE DECADE'S TRENDS

A recap of the 70s' trends in DP shows some recurring patterns as well as some formation of structures from various blocks -- reminiscent of a child's set that magically is transformed into semblances of castles etc.

(Keep in mind that it was only 1969 when IBM decided to unbundle its product line so that various parts could be procured separately. Previously IBM had bundled prices of training and software in with that of the product. The action was a continuation of a trend begun by the 1956 consent decree mandating IBM to offer products for sale as well as lease. The industry had complained IBM had a stranglehold because of cash required for leasing.)

IBM and plug compatible manufacturers (PCM)

This was the decade when others began to innovate -- in price and/or features. The popular scenario goes that IBM watched this happening, time and again in various sectors -- leasing, memory, peripherals, terminals, and now CPUs. And when the independent sector garnered a certain amount of the market, predetermined by IBM's planners, (see exhibits in any of the antitrust trials vs IBM) the giant swung into action.

- Leasing -- When lessors significantly affected the shape of IBM's earnings curves because of large purchases of first 360s and then 370s, IBM responded with fixed term and extended term plans (FTP and ETP) that diminished the price advantages lessors were offering. Much of this action occurred in the early 70s with several lessors bowing out.

- Memory -- IBM endowed its CPUs and warranted its CPUs for specific amounts of main memory. When independent memory makers decided this was a good market and there really was little reason the CPU could not handle more memory, IBM threatened not to maintain CPUs with more than the IBM-specified amount. After a law suit by Itel in Germany and a suit by Itel and Advanced Memory Systems here, IBM suddenly decided to support these CPUs. IBM continued to support a generous price umbrella for memory until it became nearly unconscionable in terms of the profits it must have been making off of its 2K chips. Usually spearheaded by its General Systems Division, the giant passed on many benefits of its memory "learning curve," dropping the price fairly steadily after 1975.

- Peripherals -- The subject of several antitrust lawsuits. The most blatent and controversial move by IBM was its "introduction" of its 2319A and B disk drives, one of which had an integrated controller, priced to combat the independents' versions of its 2314 drive. During 1970, independents had doubled their installed base of tape and disk systems, and this apparently taxed IBM's forebearance. IDC figured the independents by yearend 1970 had garnered the following shares of the domestic markets: 11% of the 360-compatible tape drive mart; 13% of the 2311 disk mart and 3% of the fast-growing 2314 mart. But the pattern was set: integrate a controller and perhaps raise prices elsewhere to compensate. Interesting today that the 4331 needs no controller for the 3310 or 3370 disks and the latest 8140's disk unit fits in the CPU box.

- Terminals -- for some reason IBM hasn't been quick to act here, in this fast growing market. Independents for some time have been having a

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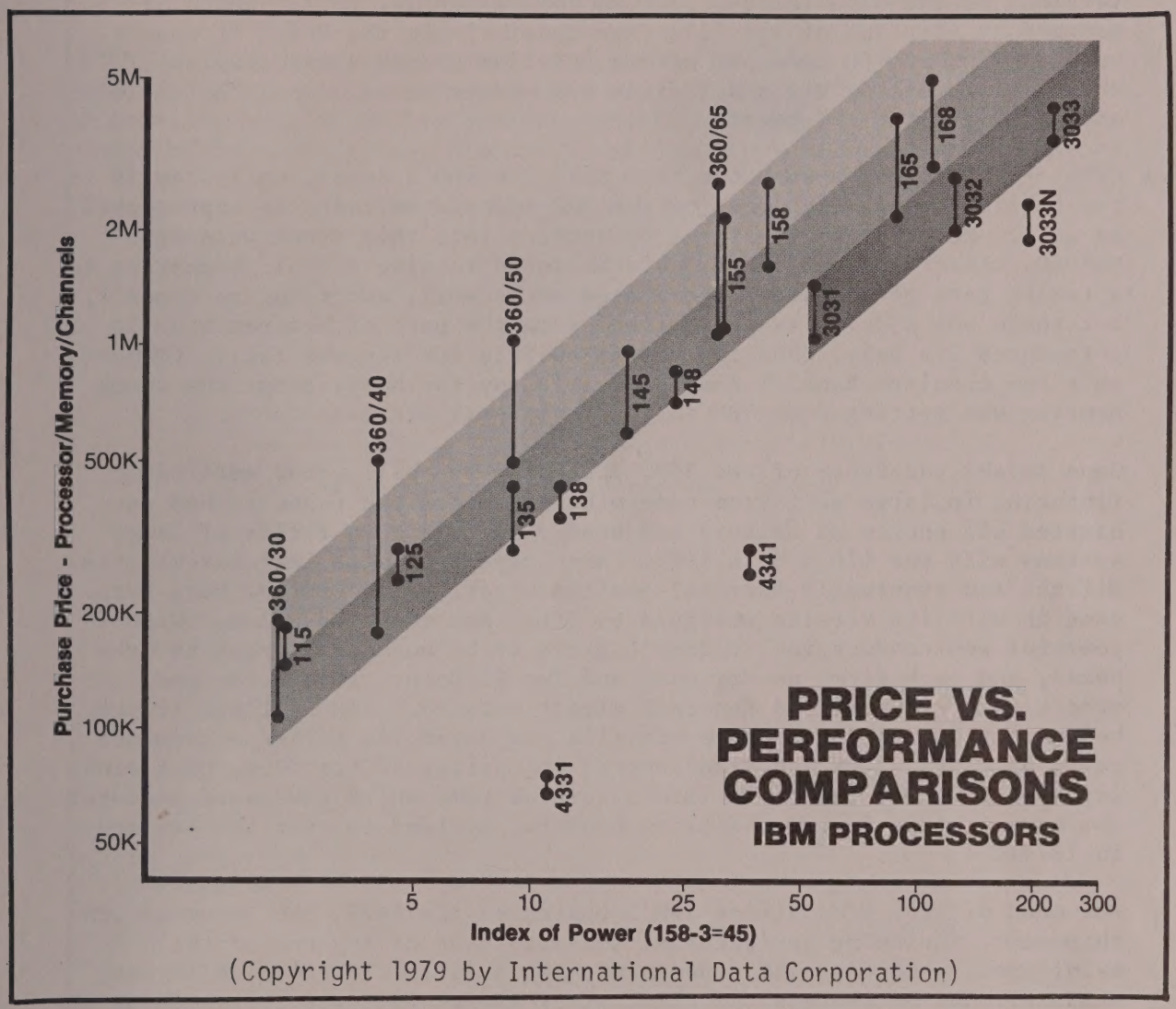

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The above chart depicts the magnitude of the hardware price/performance improvements in the IBM 4300s compared with the 370 line.

The improvement is even more dramatic if one looks at the initial announcement prices of some 370s compared with the 4300s although software can be a significant factor. EDP/IR cautions that these figures consider only hardware purchase costs, and exclude software, (there was more unbundling with the 4300s) and maintenance costs, for which a new pricing structure was announced. IDC rates the power of the 4331 vs the 370/138 as 11.0 and 11.7 respectively, while the 4341 vs the 370/158 is 37 and 41.

ORIGINAL PURCHASE PRICES
Of CPU, Power Supply, Console

4331, 1M	$ 72,500	4341, 2M	$ 245,000
138, 1M	$435,000	158, 2M	$1,370,200

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hayday putting more function into their versions of 3270-compatible devices. Finally in 1977, IBM took notice and came out with lower-price versions of the 3270 family. But in the meanwhile, independents had managed to ship 20% of all 3270-type terminals in the U.S. It wasn't until 1979 that IBM came out with a relatively dumb Ascii terminal, which it is selling via a WATS line and servicing only on a "bring it in and we'll replace it" basis.

- CPUs -- It all began with the fact that the 360's operating system is in the public domain, ergo most of the 370 systems software is unprotected, as well. Memorex was the first to venture into this arena with its MRX-40, whose designer later could be found running a small bookstore in a remote part of Montana. The system works well, according to reports, but there was a definite tentativeness on the part of Memorex when it introduced its baby, thus the parent swiftly let the axe fall. (Memorex's key creditor Bank of America wasn't any too happy about the lumps Memorex was getting from IBM in its peripheral areas.)

  Gene Amdahl, designer of the 360, picked up the ball after getting financing in large part from none other than Fujitsu (when he had exhausted his source at Heiser) and headed for the open fields of large systems with the 470 V/6 in 1975. Next came Itel with its systems from Hitachi and eventually National Semiconductor, while Control Data Corp. came in with its version designed by IPL. And then the crowd. With powerful semiconductors, it didn't prove to be much of a trick to make boxes, and such firms as Magnuson and Two Pi Corp. were born, and others such as Citel and Nanodata almost entered. IBM realized it was being generous with its price umbrella and upped its price/performance ratio with its 4300s and also lowered the prices of its 370s, thus sending some of these suppliers into a rethink mode while the users pondered the move. Itel, facing skeptical bankers, decided to exit the business in 1979.

  How much did the PCMs affect IBM's business? In 1978, the value of PCM shipments, including peripherals, exceeded that of any one of the mainframers excluding IBM. And since there is little trend to switch vendors, most of these sites came out of IBM's hide, possibly robbing it of potential additions or upgrades as well.

Software

Two events and three trends mark the decade concerning software. The events are: unbundling and the use of virtual storage by IBM, which indicated VS was an accepted concept (Burroughs, ICL, RCA had it first). Trends include: increasing substitution of memory (now cheap) so software doesn't have to be fine tuned (expensive); the growing popularity of data bases and software to handle them; and the effort to make computers easy to use.

The software industry came alive with unbundling. Initially vendors concentrated on the IBM base, but with minis and their software shortcomings, the independents expanded. The effects of unbundling are still being felt, as IBM continues to move toward unbundling its operating system. With the 4300, users can purchase part instead of all of the System Installation Productivity Option/Extended, which is associated with the DOS/VSE operating system. Applied Data Research already has a product that is a replacement -- a new

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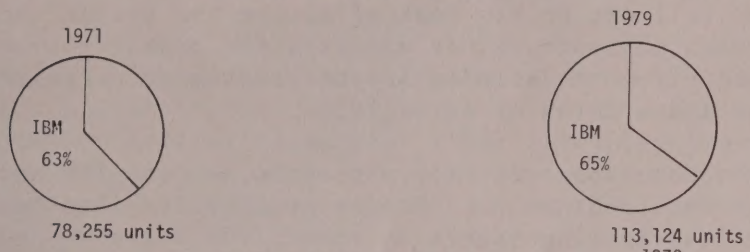
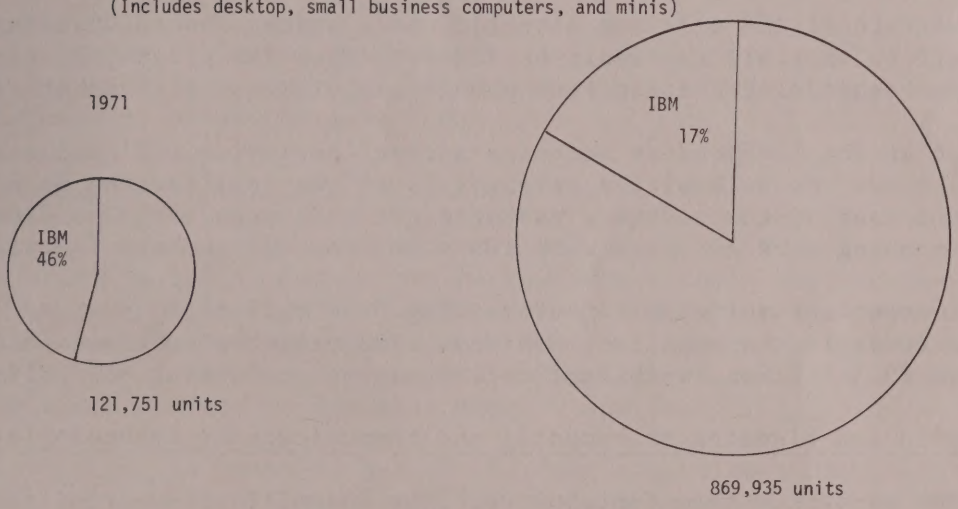
IBM'S SLICE OF THE WORLDWIDE INSTALLED BASE
(Copyright 1979 by International Data Corporation)

Although looking at the number of systems installed gives only part of the picture, one can see the proliferation of computers over the years, especially outside of the general purpose category. These charts were compiled from IDC census figures as of January 1 in the years indicated.

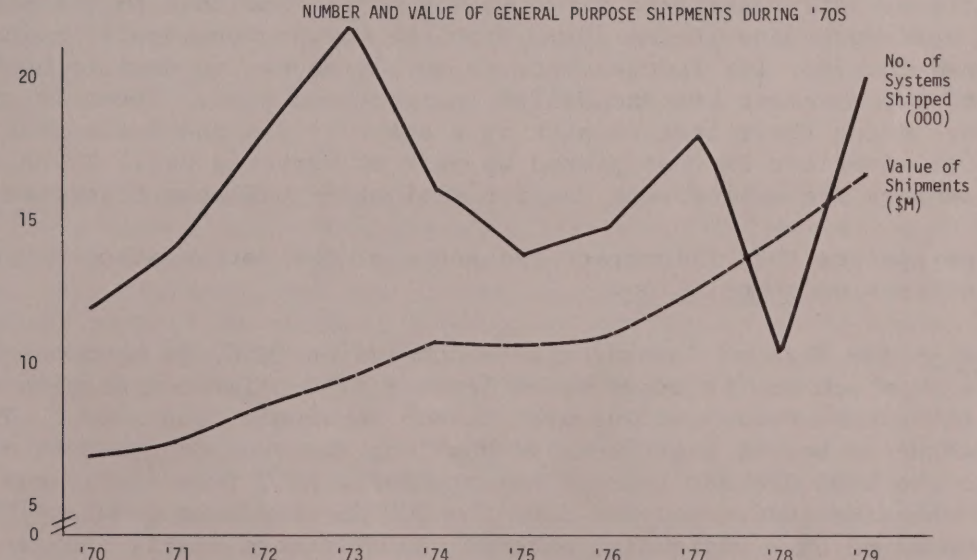
GENERAL PURPOSE



GENERAL PURPOSE AND OTHERS
(Includes desktop, small business computers, and minis)



NUMBER AND VALUE OF GENERAL PURPOSE SHIPMENTS DURING '70S



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version of its "Vollie" -- for part of the VSE/ICCF which is the on-line program development system.

Although the principle that one can select parts from various sources is attractive, examine IBM's motives for further unbundling. As revenues from hardware decline as costs decline (and competition exists) IBM is forced to look for alternative sources of cash for its coffers. Software offers an excellent means. IBM isn't always an altruist.

(While the hardware fans rave over improved price/productivity of the 4300 boxes, the jury is still out on how cost effective the systems are considering the increased costs of software -- one now pays for parts of communications software that previously were included in the program pricetag, for instance. And maintenance costs are going up as well.)

And software, or more appropriately microcode, offers IBM and any other mainframe maker the option of making changes or upgrades that could send the competition back to the drawing boards.

In the future, IBM will use microcode as a means of outdistancing and keeping off balance all the would-be PCMers. What IBM giveth, in terms of apparent opportunities resulting from unbundling, IBM can also taketh away.

A look at the independent software market (excluding all hardware vendors' revenues) shows the bulk of the revenues is in the applications area, although some independent system software packages get wide popularity -- Cincom's Total is running neck and neck with IBM's IMS for the number of installations.

The independent software market reached $670 million by yearend 1978 and nearly half was in the application arena. IDC projects software sales in 1983 will reach $2.3 billion, with applications again accounting for half.

Deregulation and blending of computer and communications technologies

The 70s merit the term fantabulous. The 80s will be supercallifragilisticexpialidotious. All roads lead first to the office and then to the home, after the spadework done in the 70s. From the Carterphone decision in 1969 which opened the door for independents to supply modems to devices hooked into AT&T's net, the movement has snowballed in scope and pace. Firms in other industries are doing their best to pick up a stake -- Dun and Bradstreet bought National CSS, American Express picked up part of Warner's Cable TV unit -- and industry members are solidifying their positions -- GTE bought Telenet.

Some key points that illustrate the scope of the deregulation movement and its implications on competition:

- AT&T -- The Federal Communications Commission (FCC) is bent on competition -- which in its books means letting AT&T offer competitive services. (Those Dataspeed 40s aren't dumb terminals, you know.) This will continue to happen regardless of how long it takes Congress to do away with the 1956 Consent Decree that prohibits AT&T from participating in the computer industry. How does the FCC do this? It grants AT&T a "temporary" OK. Obviously, once volume shipments start, how is it ever going to make AT&T exit that market? Although AT&T is revising its accounting into a uniform system of accounts, the revision is a slow and

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painful process . . . and competitors aren't convinced that AT&T's scheme will be what the industry wants to police and prevent the possibility of cross subsidy of competitive offerings with the coins reaped in AT&T's monopolistic ventures.

- Consumers have choices -- in phones, PBXs, use of specialized common carriers, modems, line monitors. (The specialized common carriers' battles to get AT&T to provide them local loops reads like a soap opera of the "haves and have nots.") Although these markets are tiny compared with AT&T, their very existence is significant.

- Integration in reverse. What's fair is fair, and it hasn't taken the computer companies long to realize they'd like to play in AT&T's backyard. Most are starting in the big blue sky with satellites -- either with their own or renting capacity. IBM's Satellite Business Systems, Xerox's Xten are examples of proposed schemes to provide end to end transportation of data without depending on Ma Bell even for local loops. It's no secret that hardware costs are declining far faster than communications costs. And it's also true that the elasticity of the communications market has not begun to be examined. Thus hardware makers in search of future revenues are eyeing the integration or at least interconnection of computer and communications facilities. (Note IBM's new modems announced last summer.)

- New ways of transmitting digital data. For starters, there was data under voice from AT&T, a method of using one circuit for both. And Digital Broadcasting Corp. has devised a scheme for using FM radio frequencies to transmit data. Not to be overlooked are cable TV, microwave, and short wave mobile radio. The FCC is letting some phone companies in remote places also own CATV stations. And yes, there's also a means of transmitting data between the bands of signals received on an ordinary TV. The wired society is indeed coming -- and fast.

- Packet switching is probably one of the most significant happenings of the 70s. Believe it or not, something close to a standard X.25 was adopted before too many people had too much at stake. The use of X.25 could pave the way for compatibility among computers. After all, Telenet (a descendant of Arpanet) has figured out ways to decode and render compatible data from various types of CPUs, thanks to smarts at both ends of its X.25 system.

Indeed, life was simpler at the beginning of the decade. There were mainframes and there were minis. Now, there is nearly total integration of manufacturers into various lines, and much interchangeability of one type of CPU for another. For instance, ask any of the supermini makers where they are selling a hefty proportion of their product and the answer is to offload mainframes, which delays the date of mainframe upgrading. Thus it can be argued that these minimakers are indeed pirating revenues that formerly would have belonged solely to the mainframers. At the same time, look at the number of mainframers that have recognized the virtues of being in the minicomputer market. Univac bought Varian, IBM brought out the Series/1, Honeywell is using its Level 6 to good advantage, even Control Data announced a mini. That leaves Burroughs as the nonconformist. But Burroughs has been aggressively pursuing the small business market with a system marketed with more bells and whistles than a mini.

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Just as we have minis infringing on mainframers' turf, we now have microprocessor systems taking over jobs once the province of minis. And the guts of nearly any modern system are either exclusively or mostly a bunch of microprocessors. The implications of micros on system architecture are far reaching, to say the least, with distributed intelligence the way of the future. As just one example, take a good look at the IBM 4300 -- especially the 3880 controller. The intelligence is getting closer to peripherals all the time.

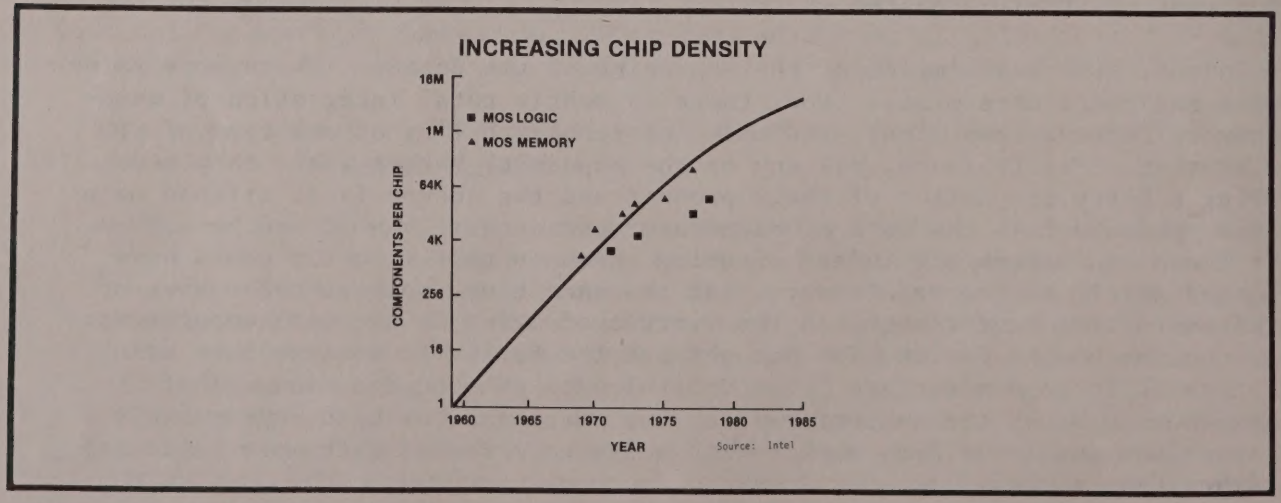
Semiconductors lead the way

Ever wonder what life would be like in the industry if Gordon Moore and his cohorts in the semiconductor industry weren't engineers, or if they listened to marketers from the mainstream of the industry? Either the industry was very competitive during its formative years or no one told the semi makers about pricing according to what the market will bear -- or that a built-in profit margin might be helpful when dealing with distributors.

The fact remains -- the pricing curve in the semiconductor industry has shown a very steep downward slope as fabricating techniques improve volume yields and the makers pass along their savings.

Observers/participants from the general purpose computer arena and from the semiconductor arena speak of maxims pertaining to price/performance improvement. Herb Grosch's law "the economy is as the square root of speed" is translated into "if you want to do something twice as cheap it's got to be four times as fast." Gordon Moore, chief honcho of Intel, observed back in 1964 that the "integrated circuits would continue to double in complexity every year." And the more that's packed on a chip, the closer everything is, the less distance for signals to travel, the faster the device. Some indication of the improvements from the semiconductor industry can be seen from the graphs below.

But just as the semiconductor industry has benefitted and pushed the computer industry into new heights of achievement and new dimensions of compactness, the flip side of the coin is that the industry has become dependent on the silicon valley suppliers. Witness the current situation with IBM ordering large quantities of 16K RAMs from various suppliers, thus drying up the supply available to others. (One minimaker characterized the move as a cheap way of hobbling the rest of the industry.)



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IBM'S MEMORY PRICES OVER TIME
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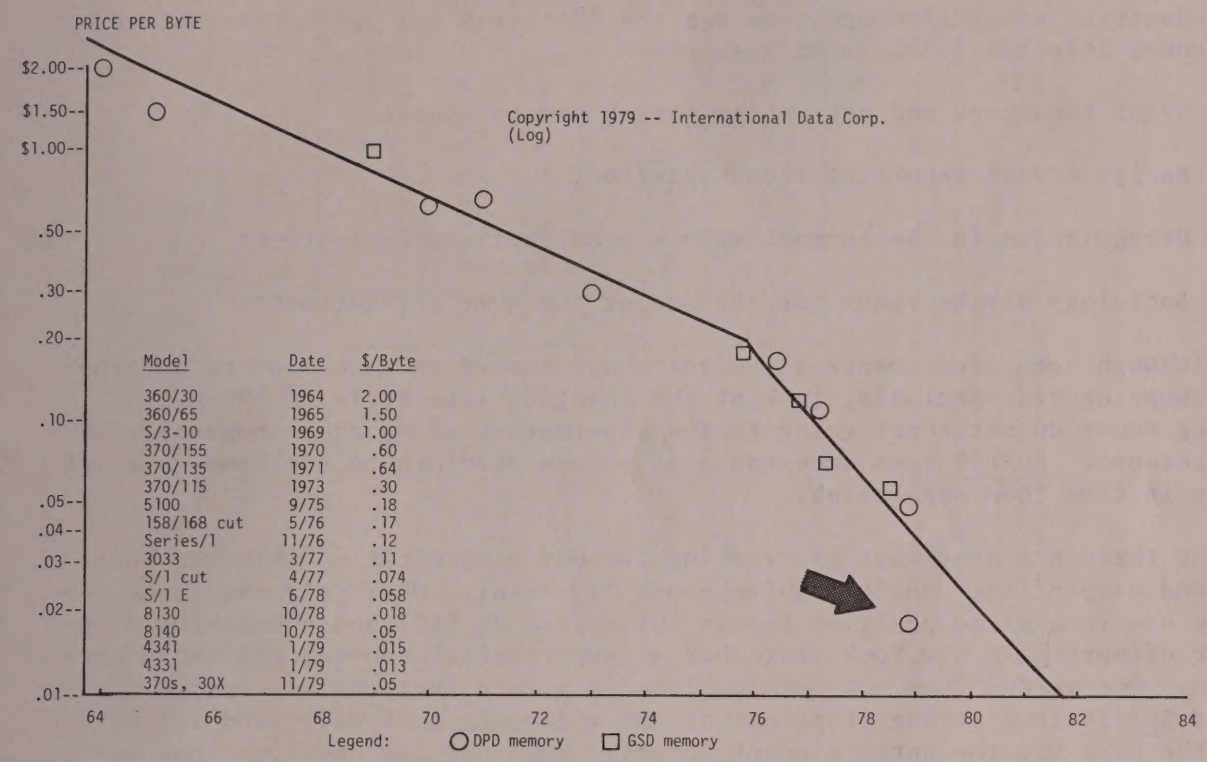
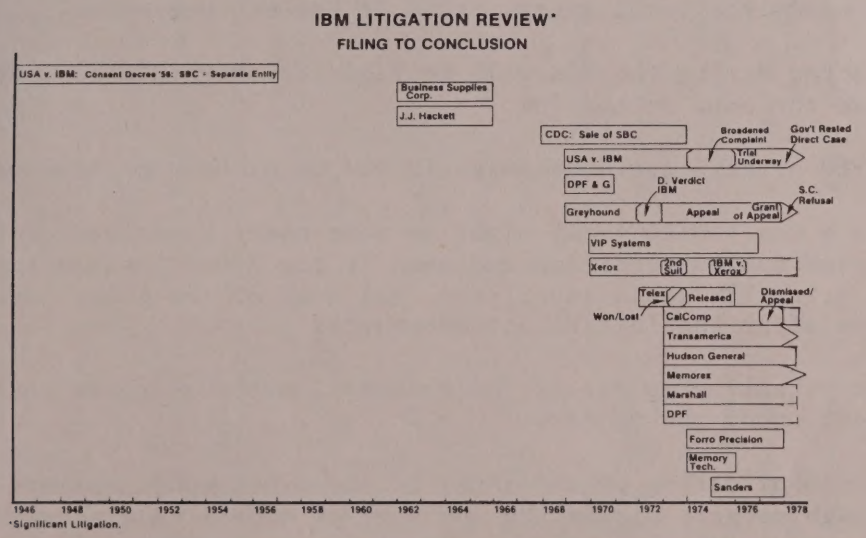


LITIGIOUS DECADE -- ANTITRUST SUITS VS IBM



The remaining suits are those by the Justice Department, Greyhound, and Memorex. Transamerica plans to appeal Judge Schnacke's ruling, after the jury was hung, that Transamerica didn't have a case. IBM has compiled a formidable track record in defending itself. Of the recent suits, The Ninth Circuit Court of Appeals refused to overturn the original directed verdict in the Calcomp case. Memorex also received a directed verdict and has appealed.

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On to the future!

The future is the home. One pundit observed that we're about to enter the networking age -- with the same widespread ramifications as the iron age or the industrial age. Although some see the 80s being the age of the office, one cannot help but think about the home.

Many of the props and motivating forces are in place:

- Energy crunch regarding transportation;
- Deregulation in the communications area inviting innovation;
- Sociology may be ready for the age of the home infotainment.

Although some experiments a few years ago bombed on such aspects as grocery shopping via terminals, look at the changing life style in the U.S. Working women do not covet going to the supermarket as do their housewifely predecessors. EDP/IR sees acceptance of remote services to the home as a lot closer in time than many think.

But there are many ways of creating two-way communication with the home now, and many of them don't require cable TV wiring. Obviously the phone companies are in a prime position here. Of course Ma Bell bears watching. One of her offspring in New York state has an experimental two-way system in operation. One needed item not yet in place is a very inexpensive storage device -- and EDP/IR is a strong proponent of the videodisk that will wend its way into the home via the entertainment budget. When one can downline load selected portions of databases compiled by services firms, the "info" part of the field should begin to take off. Right now using a terminal on an interactive basis is an expensive way of living -- but if the data can be quickly downline loaded, ready for local access, then it becomes economical.

The gating factor during the 80s will be legislation/regulation, not technology, as was the case in the 70s.

Looking to 1980 -- here are some gazes in the usual hazy crystal ball:

- IBM unveils a new series -- It might be code-named M instead of H -- and IBM might even follow tradition and name it the 380. Towards the very end of the year, IBM could unveil the real meat of the 4300, just as VS in 370s came after the initial announcements.
- No mainframers will drop out of the business, although there could be some shakeout among the PCMers.
- Continuing consolidation of the ranks of the minicomputer makers -- either through mergers within the industry or more likely acquisitions by companies from outside the industry.
- Exxon and others of its ilk will be looking for companies with nationwide networks -- Tymshare may be a likely target.
- Year of the specialized processor. The most noticeable will be the database processor, which might get hatched by the Intel/MRI team.

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IDC'S LONG RANGE TECHNOLOGY FORECAST VIA "DELPHI" SURVEY TECHNIQUE (EDP/IR, 1976)

1980

- 16K RAMS as bulk of memory shipments
- Facsimile under 15sec/page
- IBM-U.S. suit resolved
- Nonimpact typewriters widely available
- Bubble memories in commercial terminals

1985

- Computer with S/32 power available under $1,000
- 1MB microsecond access memory under $1,000
- Fiber optics for short distance communications
- Image capture systems begin to replace OCR/MICR
- Hand-held matrix printers widely available
- CPU with 370/135 capability for under $5,000
- 16-bit MPUs under 50¢ (OEM)
- Most datacomm at 1200 baud
- English Language programming commonplace
- Plasma replaces CRTs
- Nonimpact printers for most computer output
- Punched cards 90% gone

1990

- Electric autos for most urban transportation
- 4-day workweek
- Energy availability restricts economic growth
- Portable telephones widely used
- Electronic mail common
- Satellites for most business datacomm
- Most large CPU sites use building-to-building satellite transmission
- Most business decisions aided by computer models
- "At-home" computer shopping
- Powerful home computers for 1 month of executive's pay
- Most memory at remote vs. central sites
- The last general-purpose disk drive will be made
- One billion characters of millesecond access memory under $1K
- Terminal stations 80% of hardware shipments
- Voice input widely used on computer systems
- Airships for long-haul of most freight

2000

- Supersonic jets for most transcontinental travel
- Woman president of the U.S.
- Man lands on Mars
- Parents are able to choose a baby's sex
- Robots for home use
- Visual display/hard copy for most business phones
- Teleconferencing in place of most business meetings now requiring travel
- Zero population growth most nations
- Solar (and wind,wave) energy supplies over 50% of U.S. needs
- Electronic systems for newspaper, magazine delivery

2050 ... 2100

- Compatible neurological signals communicate directly with brain
- Thousands of people live in space colonies

Never

- APL as predominant programming language
- Diskette sales surpass other mag media in $
- Most personal decisions aided by computer model
- Full time programmers extinct
- Full time data processing managers extinct
- CPU and memory designers extinct
- Central DP centers and organizations obsolete

Note: Respondees were asked to pick five questions on which they felt especially confident of their answers. The resultant "expert" opinions were mixed, compared to overall survey results, but were generally bullish when it came to technological questions . . . and less optimistic when societal considerations came into play. Thus, the technology might be available for home computers, for instance, but not the social and regulatory wherewithal to make use of them.

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GENERAL-PURPOSE COMPUTER CENSUS JANUARY 1, 1971

Counts in the General-Purpose Computer Census are based on the best information available to IDC -- but are estimates nevertheless. Computer makers, as a rule, do not directly supply this type of data. General-purpose computers -- as characterized by IBM's 370, 303X and competitors -- comprise the bulk of digital computers by value. They are primarily character or byte oriented and programmed in higher-level language. Size class 5 includes the 370/148 and comparable systems.

Manufacturer	Class 2-5	Class 6-7	Worldwide Number of Installations
Burroughs	2,440	31	2,471
Control Data Corp.	535	304	839
DEC	190		190
Friden	6		6
Honeywell	8,158	150	8,308
IBM	47,731	1,304	49,035
NCR	6,544		6,544
Philco	40		40
RCA	1,796	7	1,803
Standard Computer Corp.	41		41
Sperry Univac	8,149	411	8,560
Xerox Data Systems	418		418
TOTAL	76,048	2,207	78,255

IBM GENERAL-PURPOSE CENSUS JANUARY 1, 1971

NAME OF MANUFACTURER	COMPUTER MODEL	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
IBM	System-3/6	$ 1,015	12/70	5	0	5	700
	System-3/10	$ 1,400	1/70	1570	80	1650	6700
	360/20	$ 4,200	12/65	8450	4870	13,320	900
	360/25	$ 8,000	10/68	2040	740	2780	640
	360/30	$ 12,300	6/65	7270	3200	10,470	200
	360/40	$ 22,000	5/65	3580	1880	5460	330
	370/145	$ 22,500	8/71	-	-	-	930
	360/44	$ 13,800	7/66	140	100	240	15
	360/50	$ 36,500	8/65	1420	605	2025	120
	370/155	$ 48,030	2/71	-	-	-	750
	360/65	$ 69,000	11/65	660	205	865	60
	370/165	$ 90,000	4/71	-	-	-	285
	360/67	$138,000	6/66	58	8	66	5
	360/75	$ 84,400	1/66	53	22	75	5
	360/85	$155,000	10/69	13	3	16	6
	360/9X	$150,000	11/67	13	7	20	X
	360/195	$232,000	3/71	-	-	-	16
	1130	$ 2,100	2/66	3350	1550	4900	120
	305	$ 3,600	12/57	2	22	24	X
	650	$ 4,800	12/54	8	36	44	X
	1401	$ 6,200	9/60	1810	1830	3640	X
	1401-G	$ 2,300	5/64	270	70	340	X
	1401-H	$ 1,300	6/67	80	20	100	X
	1410	$ 17,000	11/61	180	115	295	X
	1440	$ 4,100	4/63	615	500	1115	X
	1460	$ 9,800	10/63	130	60	190	X
	1620	$ 4,000	9/60	440	260	700	X
	7010	$ 26,000	10/63	39	12	51	X
	7030	$160,000	5/61	6	2	8	X
	704	$ 32,000	12/55	6	4	10	X
	7040	$ 25,000	6/63	32	27	59	X
	7044	$ 36,500	6/63	30	21	51	X
	705	$ 38,000	1/56	19	10	29	X
	7070/74	$ 27,000	3/60-2/61	176	57	233	X
	7080	$ 60,000	8/61	72	1	73	X
	7090	$ 63,500	6/60	28	27	55	X
	7094	$ 73,400	9/62	92	10	102	X
	7094-II	$ 79,400	4/64	24	0	24	X
	Subtotal			32,681	16,354	49,035	11,782

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GENERAL-PURPOSE COMPUTER CENSUS JANUARY 1, 1979

Counts in the General-Purpose Computer Census are based on the best information available to IDC -- but are estimates nevertheless. Computer makers, as a rule, do not directly supply this type of data. General-purpose computers -- as characterized by IBM's 370, 303X and competitors -- comprise the bulk of digital computers by value. They are primarily character or byte oriented and programmed in higher-level language. Size class 5 includes the 370/148 and comparable systems.

Manufacturer	Class 2-5	Class 6-7	Worldwide Number of Installations
Amdahl		203	203
Burroughs	6,507	331	6,838
CDC	502	586	1,088
Cray		8	8
DEC	812	200	1,012
Honeywell	12,205	547	12,752 *
*includes base acquired from GE of	3,751	300	4,051
IBM	67,459	6,492	73,951
Itel	100	205	305
Magnuson	6		6
NCR	5,947		5,947
Singer	2,600		2,600
Sperry Univac	6,891	922	7,813
Xerox	495	106	601
TOTAL	103,524	9,600	113,124

IBM GENERAL-PURPOSE CENSUS JANUARY 1, 1979

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
IBM	System/38-3	2	$ 3,600	8/79	-	-	-	5,000
	System/38-5	3	$ 9,700	2/80	-	-	-	3,000
	System/3-4	2	$ 1,300	6/76	580	160	740	X
	System/3-6	2	$ 1,800	12/70	740	700	1,440	X
	System/3-8	2	$ 2,100	6/75	4,850	4,250	9,100	X
	System/3-10	2	$ 2,700	1/70	6,900	4,700	11,600	X
	System/3-12	3	$ 3,800	3/76	4,550	2,980	7,530	X
	System/3-15	3	$ 6,800	3/74	3,130	2,000	5,130	200
	S/3 Subtotal				20,750	14,790	35,540	8,200
	4331	3	$ 7,600	6/79	-	-	-	2,000
	4341	4	$ 18,900	11/79	-	-	-	2,000
	3031	6	$ 61,000	3/78	230	210	440	1,200
	3032	6	$114,000	3/78	100	90	190	350
	3033	7	$180,000	3/78	220	120	340	450
	370/115	3	$ 9,300	4/74	1,040	2,370	3,410	X
	370/125	4	$ 13,000	6/73	980	1,800	2,780	X
	370/135	4	$ 20,500	5/72	1,290	1,820	3,110	X
	370/138	4	$ 21,000	11/76	1,910	2,700	4,610	200
	370/145	5	$ 39,000	7/71	1,210	1,370	2,580	X
	370/148	5	$ 34,500	3/77	1,600	1,970	3,570	50
	370/155	6	$ 72,000	2/71	440	290	730	X
	370/158	6	$104,000	5/73	1,550	1,430	2,980	X
	370/165	7	$133,000	6/71	115	42	157	X
	370/168	7	$194,000	7/73	650	310	960	X
	370/195	7	$275,000	3/71	13	4	17	X
	370 Subtotal				11,348	14,526	25,874	6,250
	360/20	3	$ 2,900	12/65	900	1,680	2,580	X
	360/22	3	$ 3,700	7/71	76	90	166	X
	360/25	3	$ 8,300	10/68	76	340	416	X
	360/30	4	$ 11,200	6/65	1,560	800	2,360	X
	360/44	4	$ 18,700	7/66	42	37	79	X
	360/40	4	$ 19,000	6/65	1,050	740	1,790	X
	360/50	5	$ 33,500	8/65	495	240	735	X
	360/65	6	$ 70,000	11/65	390	135	525	X
	360/67	7	$140,000	6/66	16	7	23	X
	360/75	7	$122,000	1/66	25	11	36	X
	360/85	7	$183,000	10/69	1	1	2	X
	360/91	7	$197,000	11/67	10	5	15	X
	360 Subtotal				4,641	4,086	8,727	X
	1130	2	$ 2,600	2/66	1,240	1,100	2,340	X
	1401	3	$ 3,700	9/60	500	415	915	X
	1401-G	2	$ 2,400	5/64	10	5	15	X
	1401-H	2	$ 1,750	6/67	5	-	5	X
	1410	4	$ 17,100	11/61	24	19	43	X
	1440	3	$ 4,700	4/63	56	78	134	X
	1460	4	$ 9,600	10/63	14	9	23	X
	1620	3	$ 2,700	9/60	94	82	176	X
	7010	5	$ 25,500	10/63	6	3	9	X
	7030	7	$160,000	5/61	1	-	1	X
	7040/44	5	$ 30,000	6/63	9	13	22	X
	7070/74	5	$ 27,000	3/60	62	9	71	X
	7080	6	$ 60,000	8/61	23	-	23	X
	7090/94	6	$ 71,000	8/60	25	8	33	X
	Subtotal				2,069	1,741	3,810	X
	Total				38,808	35,143	73,951	14,450

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• INTEGRATED OFFICE MACHINERY IS "IN" -- Datapoint and Xerox, following closely on the heels of IBM's 5520 announcement, have unveiled various schemes that include new ways of transporting information. Xerox finally announced its Ethernet system, which consists of coax cable within a building with capability to send and receive information addressed to specific devices. Ethernets in different buildings can communicate; each needs a transceiver and controller. Xerox hasn't announced Ethernet's price or speed -- known to be at least 3M bit/sec. The copier maker also reduced prices around 24% on its 850 and up to 40% on its 800 word processors and announced the 860. The 860 is upgradeable from an 850 and has more functions for word processing as well as some records handling ability. The 860 is programmable in Basic and some applications are available. The 860 costs $15,300 or $650/mo -- less than the original price of the 850.

Datapoint let loose with its word processing and electronic message system (EMS) -- which integrates voice and data by linking the company's Infoswitch (a telephone line director) with Datapoint's Attached Resource Computer (Arc) scheme. The EMS consists of a dedicated controller, a 6600, and disk. There's a one-time lease fee of $1,500 for EMS. Datapoint added word processing capabilities to the processors on its Arc systems, as well as the standalone 1800 and 1500, along with a 45 char./sec printer. A nifty item is its Associative Index Method. And then there's Lightlink, a modulated noncoherent infrared light that transmits data up to two miles and requires no licensing, designed for use with Arc. A pair of units goes for about $25K.

• IBM ADDS SOME BEEF TO ITS YEAR-OLD 8100s. Basically, the baby grew. Now the 8130 and 8140 can have up to 1 M byte main memory, and the 8101 storage-I/O unit now has two spindles -- 128M bytes. Maximum disk capacities on an 8130 and 8140 are 322M and 639M bytes, respectively. There are 14 new models of the 8140, all of which integrate the functions of the 8101 into the CPU box. Have you noticed IBM controllers are disappearing (more so than in the early '70s) or else becoming super-sophisticated boxes -- as with the 4341's 3880? Some 8140s have up to 11 communication ports. Shipments begin in the third quarter for 8130s with 750K, fourth quarter for 8140s and first quarter of 81 for an 8130 with 1M byte. Prices of 8130s range from $24K to $26K while 8140s range from $51.6K to $73K.

• AMEX PLANS ENTRY INTO HOME? Looks like it. American Express Co. is buying 50% of Warner Cable Corp., the cable TV unit that has Qube, a two way communication scheme to home TV sets. Part of the deal is the addition of a hefty $250 million line of bank credit to expand its cable TV operation. Amex cites the "extraordinary blend of technological and marketing know-how . . . (and a) future when multi-purpose communications in the home will be commonplace." At home you'll probably be able to buy your traveler's checks, and heaven knows what other type of banking-related functions Amex can pull off without being regulated. Qube, born in Columbus, Ohio, is to be installed in Houston and Cincinnati.

• DON'T HOLD YOUR BREATH department. The Post Office is having trouble cutting through the bureaucracy, to say nothing of private enterprise's opposition, to implement its version of electronic mail service. Western Union Telegraph bowed out of its pact to help implement the service.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" JANUARY 18, 1980, • VOL.15,NO.16 P.J. McGOVERN,PUBLISHER

VENDORS TARGETING DESKTOP COMPUTER MART DESPITE SHIFTING SANDS OF MARKETPLACE

The rapidly growing desktop computer market is the flame attracting vendors despite the constantly changing points of reference. The number of desktop computers installed worldwide should grow a whopping 10 fold or 45% per year between 1978 and 1983, according to International Data Corp. (IDC). However, dollar value of the shipments will grow at a somewhat lower rate as demand increases for lower cost systems as a percentage of all desktop computers.

The growth in the desktop computer market will occur despite or perhaps because of mammoth shifts in the relative sizes of various market sectors. For instance, in 1978, the hobby market was the largest piece of the pie, but it already has been and will continue to be outdistanced by the business/-professional market. But the relative sector size isn't the only change occurring; the roster of participants is by no means constant. But for every participant that bows out, another enters.

A review of relatively recent activities shows a number of firms either entering the market for the first time or increasing their range of offerings: Hewlett-Packard Co. with its $3,250 Model 85, Texas Instruments and its 99/4, and Heath Co. -- acquired by Zenith Radio. Commodore is pitching to the business market by calling its systems CBM rather than Pet, and Atari is getting software from Control Data Corp. Vendors with formidable strengths in other areas are also now in the arena, such as Sears Roebuck.

A look at the range of factors involved in the rapidly changing field illustrates how it is possible that today's market bears little resemblance to those of yesterday and tomorrow. Variables are listed in no particular order.

Markets	Channels of Distribution	Source of Vendors
Home/Hobby	Specialty Stores	Kit/Hobby Suppliers
	Other Sales Forces	
Business/Professional	Vendor Sales Force	Minis and Mainframes
	Direct Mail; WATS Line	
Scientific	Vendor Stores	Personal Computers
	Department Stores	
Education	Distributors	

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Distribution Method Key to Profitability

Perhaps the biggest puzzle facing vendors is how to effectively and profitably sell and service these systems, which are essentially low-ticket items. The patterns of distribution are changing in major ways while the jury is out and vendors are experimenting. EDP/IR suspects that others in the industry are closely watching the various techniques; they too may need to change their ways of doing business as the prices of their offerings decline.

Thus this segment of the market, which some regard as having its own ique idiosyncrasies, may be the forerunner of the rest of the industry regarding patterns of distribution.

The term "desktop computer" was chosen by IDC because it reflects the hardware parameters of the system rather than the numerous markets in which these products might be placed. Some characteristics of the desktop computer:

- Microprocessor based system, not kit;
- At least a Basic or Basic-like language if not a high level language;
- Can attach peripherals, including TVs;
- Prices range from $1K to $15K;
- Products are targeted for end use in the scientific, business, educational, home and hobbyist environments.

In looking at the market, IDC adds some additional parameters to delineate the high and low ends. Average prices for low and high end systems run from $2,500 to about $15K. The high end systems usually have larger memory capacity that allows them to handle more sophisticated software. The low end products typically use cassettes but can use floppies while high end systems offer at least a floppy; and sometimes fixed disks.

The specific markets being addressed merit a quick overview.

- The business/professional market includes businesses with revenues between $200K and $2 million and professional groups such as doctors and lawyers that use the system for general accounting-type functions. This market also includes large businesses where the system is used for tasks such as forecasting, productivity analysis and report generation.
- The home/hobbyist mart includes those computers being used in the home and purchased out of personal budgets for any of a variety of purposes including personal accounting, entertainment and education as well as hobby -- such as software development. They may also be used as a central control for devices in the home.
- The educational market is self explanatory.
- The scientific market includes use of desktop computers by scientists, engineers, technicians as an alternative to timesharing.

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DISTRIBUTION CHANNELS OF DESKTOP COMPUTERS
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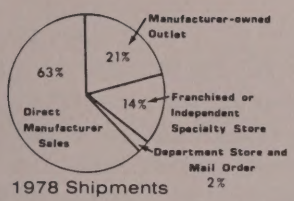
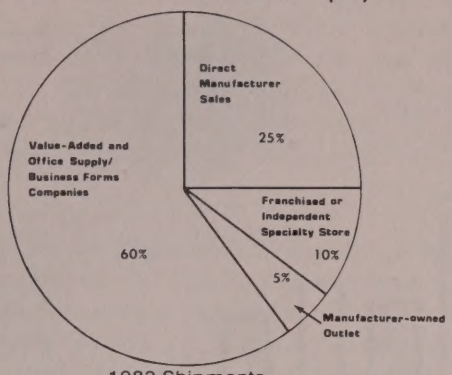
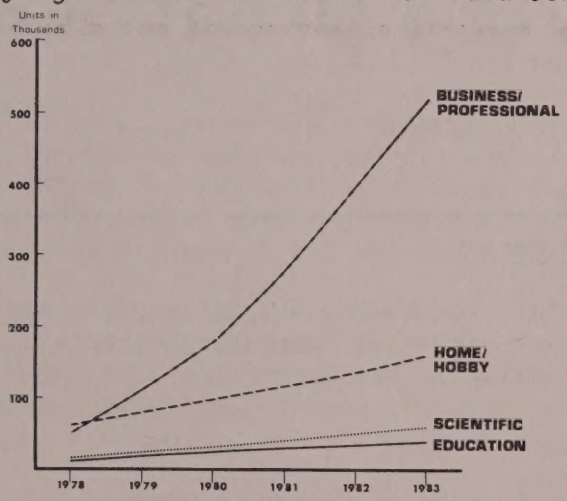


1978 Shipments



1983 Shipments

MARKET SHARE OF U.S. SHIPMENTS BY END USER SEGMENTS 1978 - 1983
(Copyright 1980 - International Data Corp.)



DESKTOP COMPUTER MARKET
U.S.-Based Manufacturers
(Copyright 1980 - International Data Corp.)

DESKTOP COMPUTER MARKET

U.S.-BASED MANUFACTURERS

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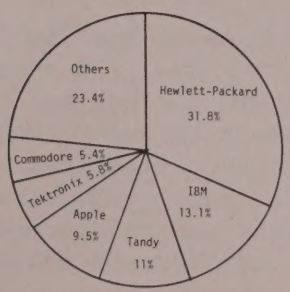
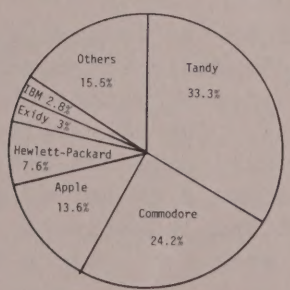


$ Value of 1979 Worldwide Shipments

$1,180 Million



Unit Shipments 1979 Worldwide

330,000

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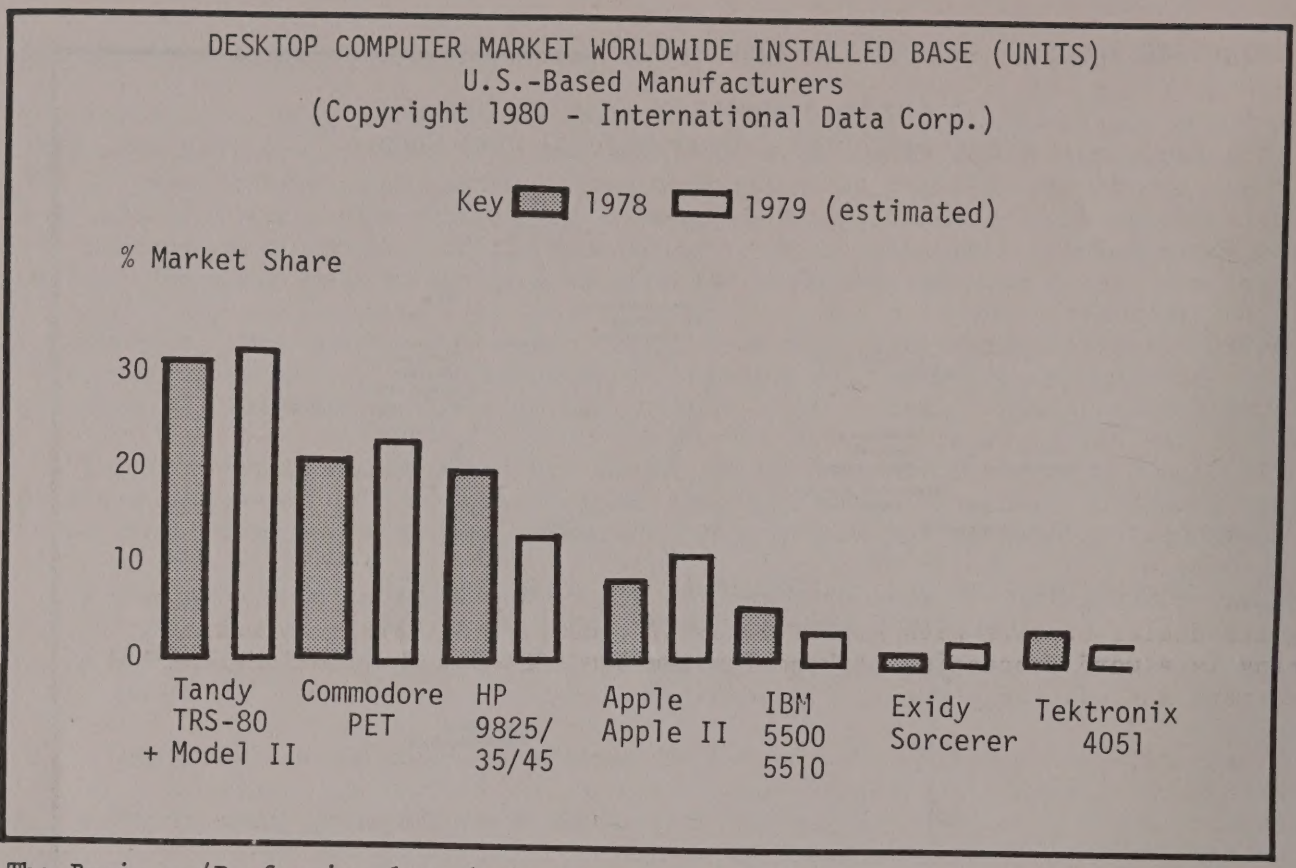

The Business/Professional Market

It is no coincidence that the number of participants keying their products to the business/professional market is increasing rapidly in line with the projections regarding the shift in the markets.

HP's 85 for Professionals

HP kept in mind the importance of packaging when it designed its portable 85 system for professionals "from the ground up." The single-box package contains a small thermal printer that performs graphics, a 5 in. CRT, tape cartridge, as well as the typing keyboard and numeric pad -- all in a package weighing under 20 pounds. The $3,250 pricetag includes the Basic language and graphics capability and a roster of 15 applications packages. Other packages, available for $95 each, include Basic training, general statistics, mathematics, linear programming, and regression analysis.

The HP 85 reminds one of the initial introduction of the IBM 5100 -- which was touted for use by individuals in organizations. The 5110 seems to be used extensively for small businesses rather than for processing information needed by a particular individual. The 85 has growth plans as well. The four I/O ports by the end of 1980 will have available four I/O interfaces: the IEEE 488 that will permit attachment of any HP peripheral; RS 232; binary coded decimal for data acquisition; and a 16 bit parallel general purpose interface. Also during '80, HP will make available a minifloppy for the system.

In the design of the system, HP has been careful to leave as much memory space as possible available to the user. Of the 16K bytes -- expandable to 32K -- 14,500 are available for the user. When the disk is offered, most of

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the disk operating system will be in read only memory (ROM), thus leaving more of the disk for the user.

The Basic on the 85, which exceeds the recent Ansi standard, is a subset of the Basic on the 9845, so those programs can be used with some minor changes, HP said. The next largest HP desktop with Basic is the 9835 which sells for $10,000. The 9825, which sells for $6K, is basically for instrument control and uses HPL. Thus the 85 marks quite a jump downward in price for HP. But then again, HP also has numerous desktop "calculators" that are fairly hefty scientific offerings.

One of the latest to reorient its line is Commodore Business Machines, maker of the Pet personal computer introduced in 1977. Commodore is labeling its 16- and 32K machines marketed to the business community CBM machines rather than Pet. In addition, the company plans to increase the availability of peripherals preferred for business applications, including an integral CRT, dual floppies and a choice of tractor or friction-feed printer. Commodore also is boosting its software oriented for office applications and is expanding its dealer support with higher lines of credit. The latest software offering is a word processing package for the CBM 2001-32B that includes global functions and editing of up to 170 pages on-line.

Last fall Zenith Radio Corp. formed the Zenith Data Systems Division responsible for Zenith microcomputer products and systems for use in both businesses and homes. Building on its acquisition of Heath Company, formerly known for its kits, Zenith is peddling a line of assembled computer products and software that was announced prior to the acquisition.

Heath had targeted the small business market with its two systems that it manufactures. The systems are a PDP 11/03 compatible unit, the WHS11A and a compact desktop 8-bit system, the WH89 which has up to 48K memory, Heath also developed basic business software. The WHS11A including 32K (up to 64K available) costs around $6,289, whereas the smaller WH89 is priced around $2295. Prior to its acquisitions, Heath had laid the groundwork for marketing through a separate sales organization, and regional field service reps in addition to Heath's network of service facilities. In addition, Heath had "built sufficient margins into the prices of ... systems to make handling the products highly attractive to distributors/retailers and OEMs." The company also developed basic business software packages.

There are desktop computers and then there are desktop computers, just as there are a number of different markets for the systems.

The 85 presents a sharp contrast in appearance as it sits side by side Texas Instruments' 99/4 in stores carrying calculators and video games. But its market is the home and its price is also very different -- $1,150 vs. $3,250 for HP. The 99/4's keyboard looks like it should be on a video game system and gives the impression the system isn't too powerful although it has 16K, much of which is available to the user because the software is contained on solid state modules which are oriented to that market. The software ranges from $20 to $70 per module.

Although it looks like the TI 99/4 may have missed the mark in pricing for the home market, there is a reason. The price tag of the 99/4 includes a large color TV-like screen because the Federal Communications Commission

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didn't allow TI to hook directly to TVs last summer when the product was introduced. Now that the commission has issued a temporary waiver, with further pressure to make the waiver permanent, TI is expected to charge ahead into the home market with a lower price tag on either this system or another one. Radio Shack seems to have found its entry level price tag of under $600 a popular price.

In line with its orientation to the home market, the folks that brought us Speak and Spell endowed the 99/4 with a speech synthesis module so home programmers can place verbal messages in their programs. The day of the talking computer is here, folks, ready or not. The synthesizer costs about $150.

Same old calculator war?

It looks like the same old calculator game all over again. Remember when it was HP vs TI and vice-versa? EDP/IR suspects the two will stake out the same turf again -- with HP not getting too involved in the low-end of the price spectrum and TI running the gamut from high to low. It's likely TI has something in the pipeline that will compete more with the 85 by being oriented to the individual user in an organization. Originally announced exclusively for the home market, the 99/4 seems to be getting a new orientation from TI. A spokesman has recently been quoted as indicating the product might find its way into the business/professional mart.

Distribution avenues key question

Vendors are finding that marketing a low-ticket item requires some new techniques -- thus the race is on to link up with existing sales forces that are visiting potential prospects of desktop computers for another reason. Texas Instruments came up with one of the largest initial efforts in this direction with its agreement with Moore Business Forms to handle its larger system 990. And other computer vendors seem to be investigating the office equipment sector to assist them in their marketing programs.

HP is taking a multiple marketing approach for its 85. HP's desktop computer sales force will add the 85 to its quiver; retail dealers such as computer stores are already stocking the 85; and office equipment suppliers will also handle the system. Rather than using a nationwide office equipment firm, HP has lined up a number of smaller companies, some with multiple outlets.

Digital Equipment Corp. is selling a limited assortment of small systems through its own DEC retail stores. IBM is taking a somewhat more moderate approach by putting showrooms -- stores -- in several of its branch offices. Still others are selling through various retailers, such as computer stores, that offer a variety of products from which the consumer may choose. The concept behind the retail store is that the small businessman, unfamiliar with the computer industry, will shop for a computer as he would a refrigerator -- through a store.

In fact, both buyer and seller are in need of "match makers." From the vendors' view, it makes eminent sense to have an agreement with a firm that has a sales force familiar with the potential clients' operations, such as an office equipment supplier, to ferret out the potential customer of a desktop computer for business use. Similarly, buyers unfamiliar with the computer industry face a real challenge in trying to find dealers of small computers.

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Computer vendors per se aren't necessarily listed in the Yellow Pages, so the consumer turns to the stores. And even if one does know what vendors are in the business, some of them deal only through distributors, who, in turn, may only sell to firms of a certain size. It is a zoo.

Another market for desktop computers is departments within a large company. This requires an entirely different approach, and Pertec seems to think it has found a way of wooing these potential users. However, Pertec seems reluctant to explain its techniques.

And then there's the HOME

Although IDC figures show the market for home computers losing its preeminent position as other sectors grow faster, there is no lack of action in this segment as players jostle to position themselves both for current and future market demand. EDP/IR finds the home mart one of the more interesting because of the vast possibilities of merging technologies and potentially changing the way people think of doing things.

The home market is much broader than simply the home computer market. There are many elements that will be melded into what is now commonly perceived as "blue sky" offerings. Some of the more far reaching innovations come from the impact of different ways of communicating. Think about home transponders and receivers for satellite communications; broadcasting via the space between lines on TV sets, to name a couple. (Digital Broadcasting is already using space in FM radio frequencies to transmit data.) And then there's IBM with its scheme that is said to permit digital communication without wires within a room.

Storage will change in price so that it no longer is necessary to run up hefty phone bills and time charges with service bureaus that are keeping the data bases one needs. Video disks will be everywhere -- witness the recent pact CBS signed to manufacture and market RCA's videodisks -- and inexpensive -- there's talk now about prices being under $500.

EDP/IR suspects the future home computer may have some intelligence and manipulative capability but that users will depend heavily on inexpensive access of large data bases. They will put the pertinent data on their videodisk and massage it locally.

Some recent activities in the home arena:

- Comsat is negotiating with Sears Roebuck for a possible joint venture that would offer satellite-to-home subscription television service.

- Atari has signed a licensing pact with Control Data Corp. to market eight investment applications programs from the Cyberware library for use with the Atari 400 and 800 computers.

- Games may be games now -- but they may transform. For instance, Mattel's Intellivision system is scheduled to evolve into a home computer. GTE has been licensed to make and market the hardware for the system. The unit now has a couple of hand-held controllers, but a keyboard is expected to be announced this year.

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• THE 38 GETS A BIRTH DATE OF JULY, 1980 -- nearly a year behind schedule. Software reportedly has been holding up release of the system. It's probably not a coincidence that General Systems Division raised the maximum memory on both models of the 38 by 1/2 Mbyte -- to 2M and 1.5M -- using the previous price/byte. EDP/IR suspects this is a cryptic message to the wise to upgrade memory size before taking delivery. The move raises the upper price range to $194,245 for the Mod 5 with 2M and 387.1M disk. GSD also tantalized its System 34 users with double the maximum memory -- to 256K -- and double the disk space -- to 128.4M -- but they'll have to wait 'til 1981 -- February for the main memory and August for the disk. Looks like IBM is rationing its chips. Word has it IBM is seeking to buy chips in Japan as well as in the U.S.

• FURTHER INCURSION INTO BIG BROTHER'S TERRITORY. General Systems Division announced availability in February 1981 of a finance subsystem package for the 3600 banking system that will enable the 3600 to be supported by System 34. Previously the smallest CPU to which the 3600 could link was the 370. Software costs $125/mo.

• AND THE DOUBLE WHAMMY FROM GSD just may be the 5280 "Distributed data System -- a family of programmable diskette-based terminal products." If DPD can acknowledge distributed processing with its 8100, the turf is fair ground for GSD. But although the terminals link with 370, 303X and 4300s, with both bisynch and SNA/SDLC, they cannot link to the 8100. Interesting. Should be a big seller with the IBM nameplate, and the upper end is competitively priced. Cobol can be downline loaded but not compiled; the system can compile its DE/-RPG, which is not compatible with RPG programs. Price of a representative configuration with a programmable station, 64K, 2.4M of diskette and a 120 char./sec 5256 serial printer (also new) and communications adapter is $16,660 or $517/mo on a two-year lease.

• IBM SPEWS PRICE ADJUSTMENTS IN RAPID-FIRE FASHION -- acknowledging inflation in its hikes on rental and lease and generally making purchase more attractive. Shortly after DPD's November purchase price cuts on 303X and System 370 memories, GSD cut purchase prices up to 15% on the System 3/12 and 15, 32 and small 34 CPUs. Memory prices were cut as much as 33% on the high end Series 1/4955, S/3 Models 8, 12 and 15 and the S/32 and S/34. And then, miraculously, the announcements were in synch the end of December -- including DPD, GSD and OPD products. Rental and lease charges generally go up 7% April 1. DPD elected to raise purchase prices on its newest lines, the 4300s and the 8100s about 5% effective immediately. And, in the volume discount arena, GSD reduced the quantity of Series 1s that qualify for various discounts.

• THE PLUG COMPATIBLE MAINFRAME ARENA HEATS UP. National Advanced Systems unveiled three Hitachi CPUs and two NAS CPUs. The Hitachi units are: the 7000 DPC dual processor based on a Hitachi AS-7 announced but never delivered; the 7000, based on the AS/6; and the 7000N, which is less powerful than the 7000. The DPC, said to be equivalent to the 3033 running MVS or VM 370, is priced $500,000 less than IBM. The NAS systems are the 3000 series: the AS 3000N, equivalent in performance to the 4341, and the AS 3000, equivalent to the 370/158 Mod 3, priced at $425K for 2M. The 3000N represents a new tack for a PCM -- the price of $325K for 2M is more than the 4341. And Amdahl is following IBM's lead, raising its lease prices 6% to 9% effective March 15. Amdahl also tacked on higher prices for software.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" JANUARY 31, 1980 • VOL.15,NO.17 P.J.McGOVERN,PUBLISHER

IBM Adds 5280 Distributed Data System

GROWTH OF U.S. LARGE GENERAL PURPOSE COMPUTER BASE OUTPACES THAT OF SMALLER SYSTEMS IN U.S.

It's hardly any wonder why computer manufacturers have been smugly smiling over their improved financial returns over the past few years. The installed U.S. base of large general purpose computers has more than doubled in units since 1971, whereas the base of smaller general purpose systems grew only 10%. EDP/IR here defines large computers as International Data Corp.'s size classes 6 and 7 -- those equivalent to the 370/155 and above. It seems logical that margins on large boxes are better than on small boxes.

Some observations about growth in units among the various size classes:

- Size classes 6-7 increased their share of the total general purpose U.S. base from 4% at yearend 1971 to 10% at yearend 1978.
- Size classes 6-7 grew 156% between 1971 to 1978 while the total base grew a mere 16.6% in those years.
- IBM showed a larger increase in the size classes 2-5 arena than in the large-scale category, although it managed to keep its share in each category above 60% of the total installed base. Among the smaller general purpose computers, IBM's share rose from 63.2% in 1971 to 66.9% in 1978.

IDC predicts the large computer category will continue to outpace the medium and small general purpose area, and could expand from 10% at yearend 1978 to 15.7% of the U.S. installed general purpose base by 1983.

The period of greatest growth for size classes 6 and 7 was from the end of 1971 to 1973, when the large computers compiled a 53.6% growth. However, even after attaining a larger base, this sector consistently racked up a growth rate of over 20% from 1975 to 1977 and in 1978. At the same time, the smaller general purpose base declined 9% between 1975 and 1977 and 2% in 1978.

Of course, much of the key to the growth in large systems can be found by examining IBM's activities. A look at IDC figures in size classes 6 and 7

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U.S. INSTALLED BASE GENERAL PURPOSE COMPUTERS
12/71-12/78
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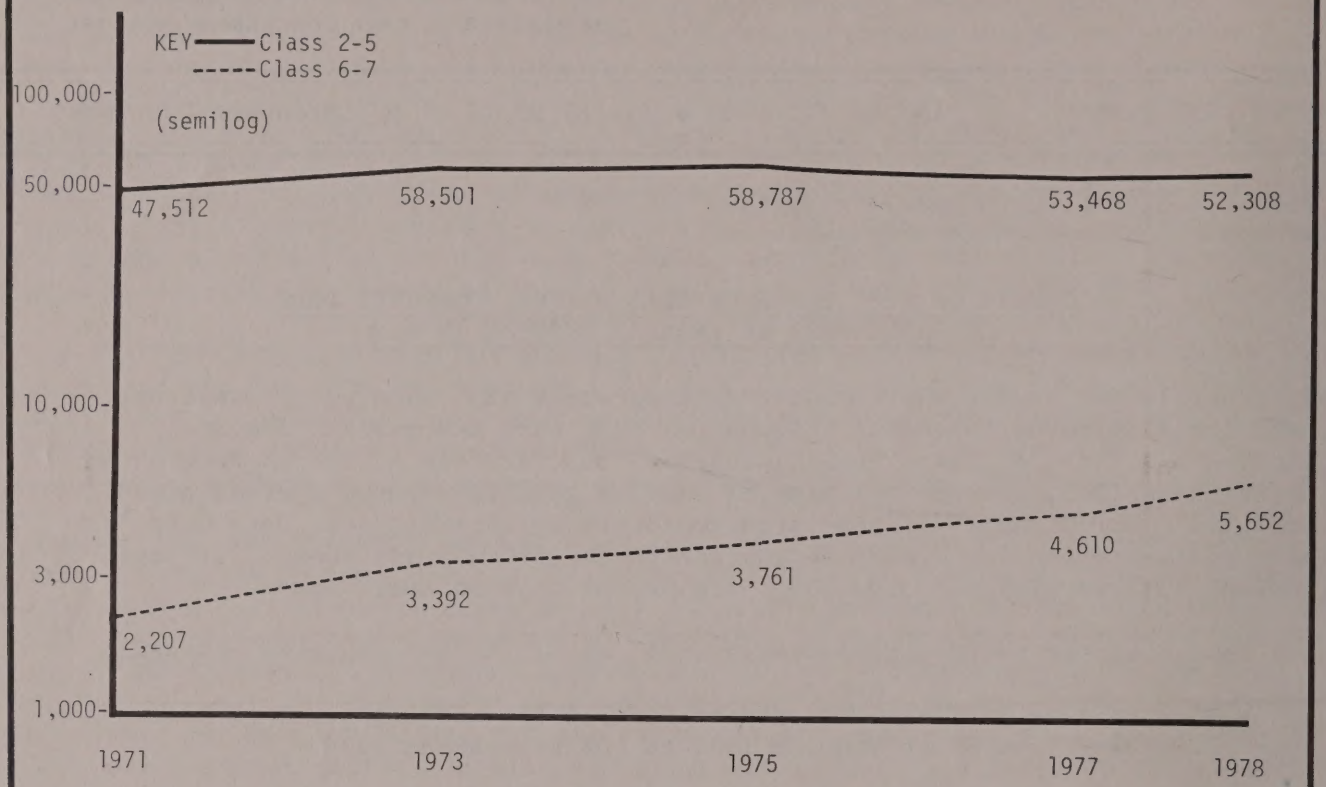

U.S. INSTALLED BASE OF IBM GENERAL PURPOSE COMPUTERS
12/71 - 12/78
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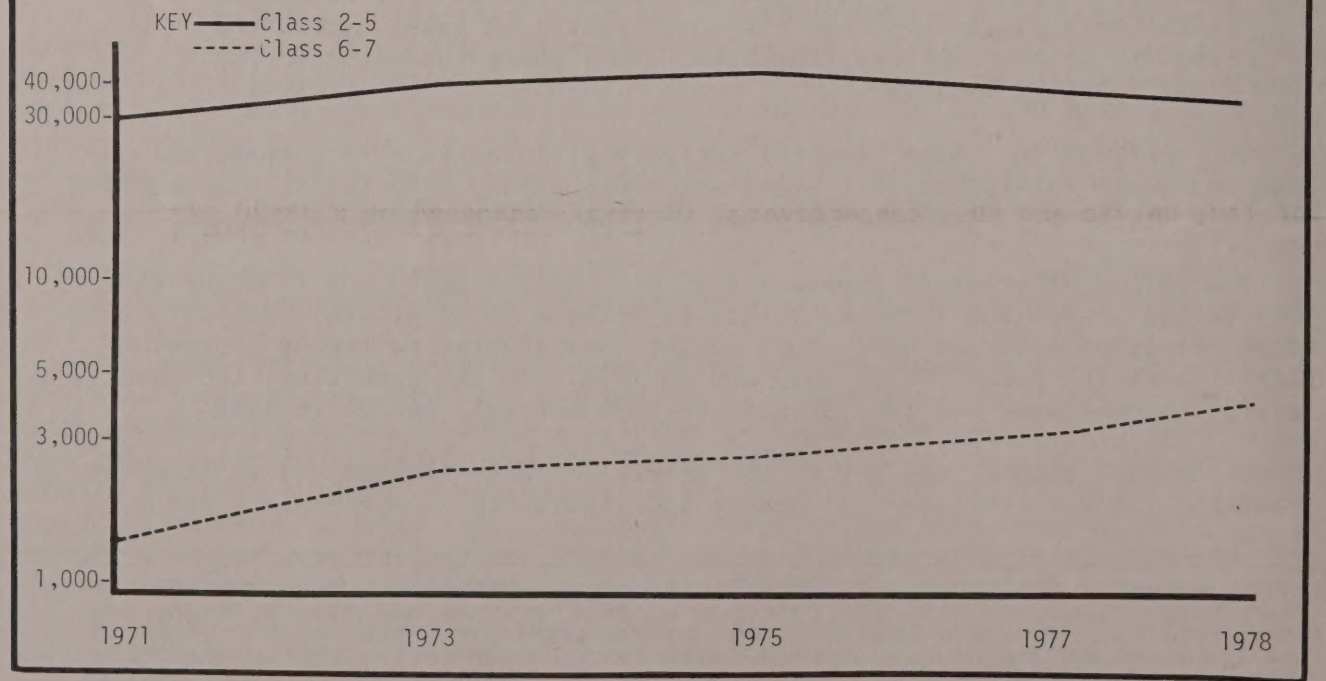

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SOME VENDORS ADDED
TO THEIR U.S. BASES IN CLASSES 6 - 7
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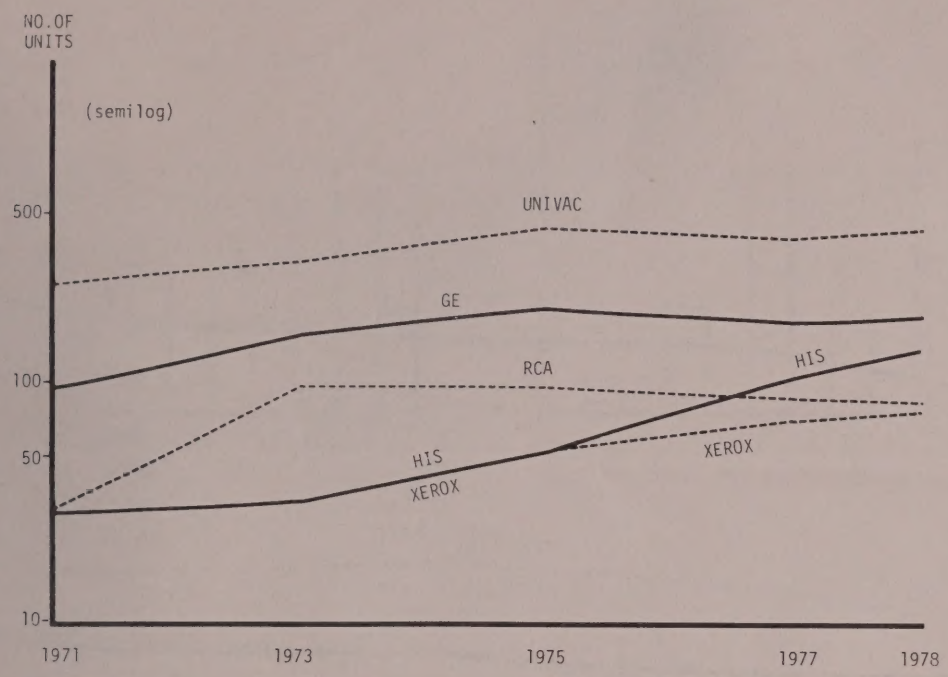

reveals the IBM installed base constituted 68.5% of the total large-scale base in 1971 and 67.4% in 1978. With the advent of the 370 and virtual storage, large computers became almost more necessary than before -- for prestige if not for practical reasons. Also, the seventies were the age during which nearly everything went into the (centralized) data processing realm, so machines quite naturally grew.

Also, some vendors added substantially to their bases by acquiring those who went out of the business. Looking at the graphs, it is hard to discern any rhyme or reason why some vendors stayed and some departed. For instance, Xerox, whose CPU business was born Scientific Data Systems, showed a quite healthy rate of growth in the large-scale systems area. In fact, it was running neck and neck with Honeywell. And GE's large systems base ranked fourth after IBM, Univac and CDC, respectively, in 1975. Although GE's large computer base was nearly double that of Honeywell in 1973, who emerged with a substantial large-scale base through acquisition? None other than Honeywell, which eventually acquired the bases of GE and then Xerox. Events were a bit more predictable in that Univac, with a much larger base, acquired RCA when it decided to turn its attention to TVs and military contracts and satellites.

The above graph tracks bases as separate although they were acquired along the way, whereas on the next page the graph shows these bases merged with the surviving entity. Univac was number two before adding the RCA base, and retained that position. HIS, thanks to its addition of GE, managed to pull level with CDC. Attention should be paid to Burroughs, going it alone, which has shown an impressive and fairly steady growth rate from 32 systems in 1971 to 199 in 1978. And the latecomers, DEC, Itel and Amdahl, all were hovering around the 150 mark in 1978 -- very impressive in a short amount of time.

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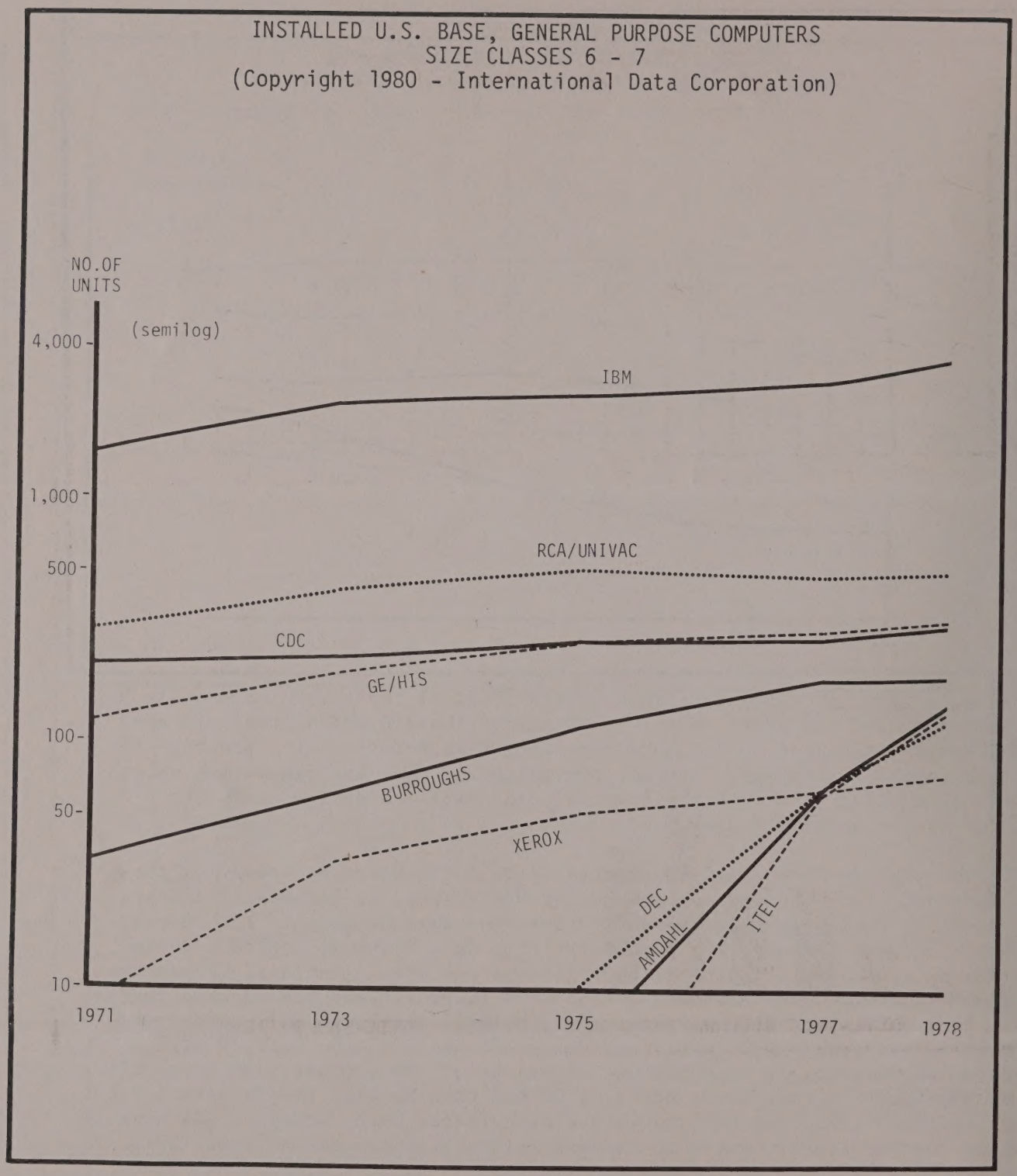

While the previous graphs present a good idea of growth in installed domestic base over time, the graph on the opposite page shows some major mainframers' bases in a snapshot taken at the end of 1978 along with a composite industry profile.

A brief explanation of IDC's size classes. Class 2 includes systems of the size up through IBM's 3/10; Class 3, 370/115; Class 4, 138; Class 5, 148; Class 6, 158; Class 7, above a 158.

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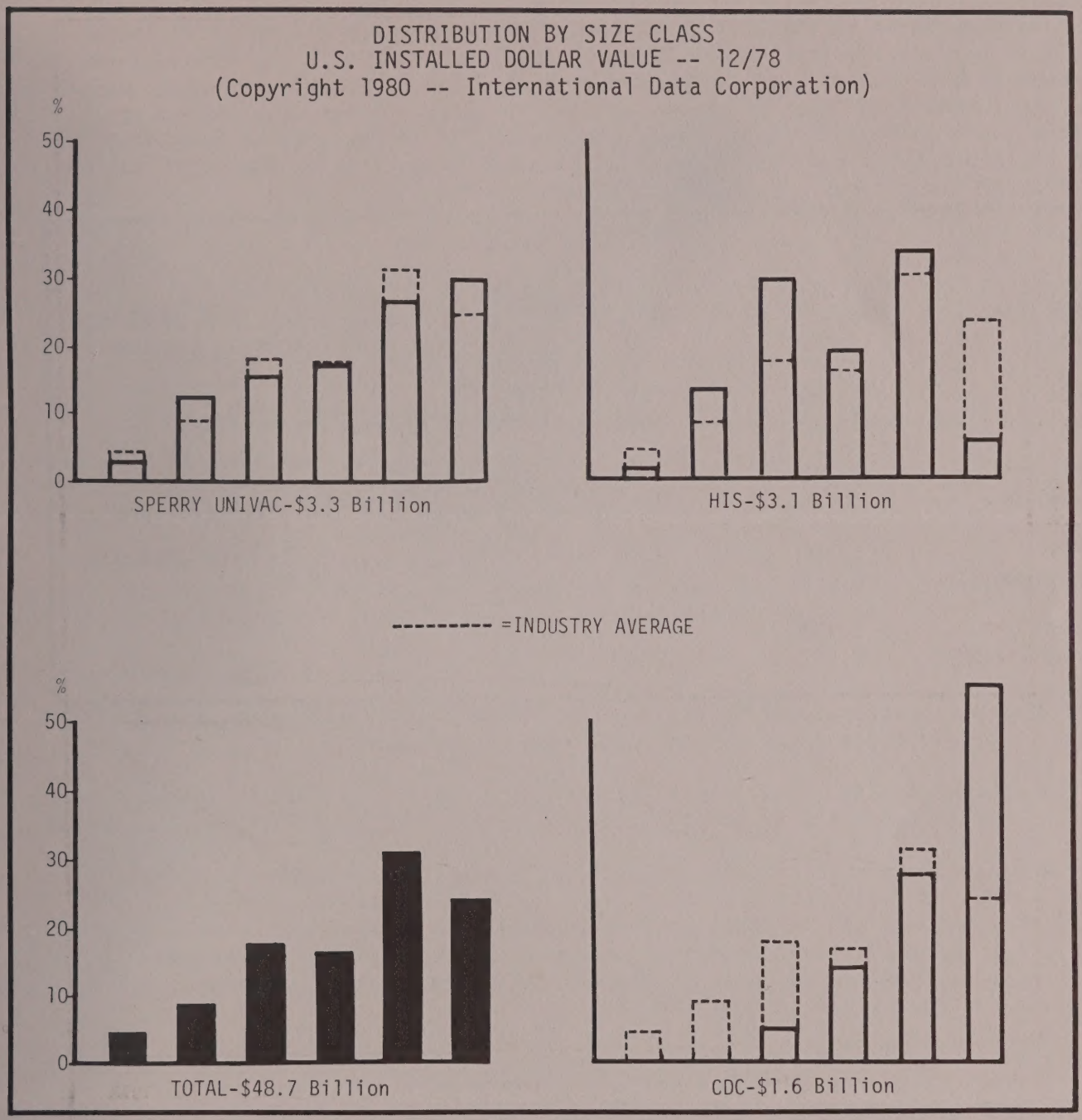

IBM 5280 -- GSD PICKS UP
THE DISTRIBUTED PROCESSING BEAT

IBM has filled a gap in its line of terminals with the 5280 "Distributed Data System." But it was General Systems Division that unveiled the system which would appear to be the little brother to Data Processing Division's 8100, announced in Fall 1978 as "the biggest announcement since the 360." The 8100 began IBM's acknowledgement and courtship of the DDP world. And DDP has moved from buzzword to reality -- the DDP market reached $2 billion in installed base in 1979 and should grow to no less than $12 billion by 1983, including minis, small business computers and processing (intelligent) terminals. By the end of 1983, IDC says there could be as many as 220,000 processors at operating nodes within U.S. DDP networks.

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As the graphs on the next page show, IBM hasn't taken the world by storm with its processing terminals. However, the 5280 along with the 8100 should remedy this situation. The GSD product is aimed at both small and large users and is intended to "meet a variety of user requirements for data communications, data entry, and associated processing." It is designed to feed data entry into Cobol-based CPUs as well as to expedite data entry for local use in the DE/RPG language.

THE 5280 FAMILY

Models	Purchase	Two Year Lease	Features
5288 controller	$ 5,900 13,700	$155 392	memory 32- 160K, diskette 1/4M - 4.8M in its box
5281	2,035	50	
auxiliary	5,425	155	diskette to 2.4M
5282	2,310	55	
auxiliary	5,700	160	diskette to 2.4M
5285	5,280	155	memory 32- 64K, diskette
programmable	8,080	238	up to 2.4M
5286	7,100	190	" "
programmable	8,900	238	

Although touted as a 3740 replacement, there is much more under the 5280's covers, and is notable for several features. The 5280:

- Adheres to IBM party line of central site control in that it cannot compile Cobol but is downline loaded, reminiscent of 8100 DPCX.

- Doesn't communicate with the 8100, although it does to nearly every other IBM machine. (Diskettes with the 8100 can be compatible.) Communications are switch-selectable SNA/SDLC or bisynch to hosts, but the 8120 itself cannot support remote terminals via communications. The provision of bisynch may be a tacit acknowledgement that the world isn't rushing into SNA.

- Should be a very attractive, competitive offering, especially the smart terminals, striking at the territory built up by Datapoint, Mohawk and others over the years.

But user confusion may abound -- there are lots of model numbers in this family. There are four terminal models and a separate box controller. Basically the family divides into the smart and not so smart; the models with higher numbers, 5285 and 5286, have controllers and main memory built in, whereas the 5281 and 5282 "auxiliary stations" need the controller in a separate box, the 5288. The 5282 and 5286 are dual stations in one unit.

It looks like the 5285 and 5286 with their built-in controllers will be the 3470 replacement, while the separate box controller, the 5288, will have distributed processing as its mission. IBM has retained its affinity for clustered processing through a couple of schemes. The 5288 can support up to four keyboards of the 5281 or 5282, six diskettes and four 5256 printers

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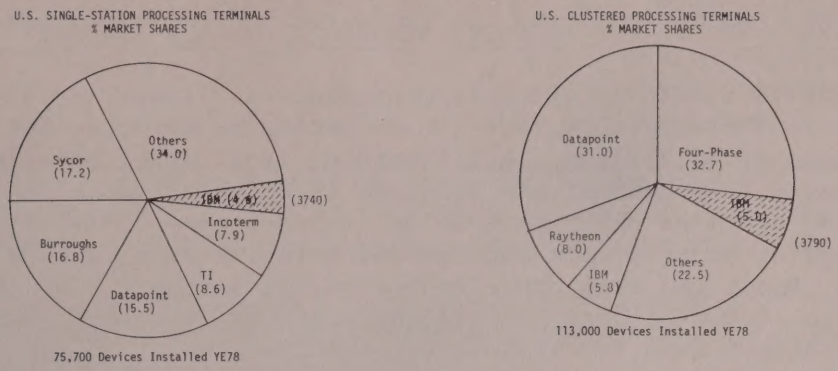
HOW IBM STANDS IN PROCESSING TERMINALS . . .



The 5280 will fit somewhere in the two markets above (as will the 8100). Because only two of the models are single-station, the bulk will probably fall into the "clustered" category.

(serial matrix) and one 5225 line printer. (A cable through feature allows attachment of multiple printers on a single twinax cable). Users can have print speeds from 40 char./sec to 560 line/min.

And the 5285 and -86 can support a 5281 or 5282 -- for a total of four displays/keyboards. To promote the clustered concept, communications adapters are available only on the smart terminals and the controller.

Communications Costs

Communications isn't without a cost. The bisync capability needs a minimum of 32K of main storage while the SNA/SDLC needs a minimum of 64K. If one wants a choice of either protocol, that's 96K right there. Thus the user has to either get that additional main memory via another smart terminal (the auxiliary ones don't have any) or by a 5288 controller.

Capabilities

A look at what IBM says about the controllers shows these are not simple machines. The controllers have multiple microprocessors allowing processing and I/O devices to operate independently. They also feature multiprogramming with up to eight main storage partitions and what is probably microcode to offer several data editing functions. Using diskettes from other terminals, a 5288 can handle up to 9.6M bytes (eight drives).

None of the units can compile Cobol, which is either OS/VS or DOS/VSE downline loaded. The 5280 DE/RPG is compiled locally on the smarter terminals and the controller and is designed for data entry. RPG programs will not run on this system, but there is a facility for converting 3470 programs to 5280 DE/RPG. There's an RPG III subset capability for subroutines and standalone programs, and a variety of sort merge and utilities, including nifty diskette handling items such as copying a data set from one diskette to another using only one disk drive. Diskettes come in three flavors, with capacity ranging from 303K to 1,212K.

IBM says a representative configuration consists of a 64K smart station and 2.4M diskette, a 120 char./sec 5256 printer and communications adapter leases for $517/mo and sells for $16,660. Shipments are scheduled to begin in June, 1980.

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• IPL AND OLIVETTI SIGNED an OEM agreement whereby IPL will supply Olivetti with its range of IBM-compatible CPUs for marketing in Europe. The initial contract is pegged at $5 million. IPL President Steve Ippolito said he expects to eventually ship half of his machines to Olivetti, doubling IPL's business, which also supplies CDC with CPUs on an OEM basis. Olivetti, currently the largest supplier of terminals and communications gear in Europe, plans to penetrate Italy, Spain and then other countries, with emphasis on service. IPL's revenues in 1979 were over $12 million, up from less than $5 million in 1977. IPL has shipped over $25 million (in transfer price) of machines to CDC and has an installed base of about 130 machines. (It shipped about half of that amount in 1979.) Olivetti will also handle larger PCM models obtained from Hitachi.

• PRIME UNVEILS ENTRY LEVEL 32 BIT SYSTEM with models for systems houses and end users. The 150, intended for systems houses, costs 256K and $49,000 in single quantity, while the 250 for end users includes 500K and CRT for $59,500. Prime expects these to be used as nodes in Primenet and also to expand the base of Prime sites. The 250 is 60% of the speed of the 550 and can handle up to 16 terminals. The 150 is board upgradeable to the 450, the next largest offering for systems builders. Prime's growth continues almost non-stop; 1979 earnings rose 102% to $16.9 million (including $1.2 million credit) on a 63% rise in revenues.

• IBM TAKES A STEP CLOSER TO COURTING the first time user with the 5120 -- a lower priced repackaged version of the 5110 -- six IBM application packages supported via a hotline and a programmed selling tool. The packages, accounts receivable, payable, general ledger, inventory, billing and payroll, each cost $60/mo for 24 months or $1,420 total. The report generator, Brads, is also available for $85/mo for 12 months. The 5120 will handle programs written for the 5110, but the packages are available for the 5120. (5110 users had to write their own or use field developed programs, which aren't supported by IBM.) Maintenance is $131/mo on the standard configuration.

IBM has been selling 5110s off the shelf of 50 Business Computer Centers since last summer and will continue with the 5120 as well. To aid in sales to novice users, IBM has on the system a menu driven package that walks the customer through the intricacies of using a computer for business and also various levels of complexity of the system. The package will even tell the prospect whether the 5120 is suitable for his needs. (It would appear this eliminates the need for highly trained salespeople.) A standard system with Basic, 32K, dual floppies (2.4M) and 120 char./sec printer goes for $13,375 vs $16,845 for a 5110, which is now in limited new production. There's little new hardware. The screen is bigger (9 in., 1024 characters) and the dual density disk drives are integrated in the box, which IBM says contributes to the reduced price.

• IBM's SYSTEM 38 IS ALIVE AND WELL and living in about 200 IBM installations around the world prior to its first customer shipment date in July. IBM managers told the press that the reason for the delay was an underestimation of the time necessary to test the machine in various environments. The integrated relational data base came up clean without a hitch, they said. It looks to EDP/IR like a pretty capable system, and the data base makes it very easy to massage data and prepare customized reports.

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TECHNOLOGY'S TASK TO UTILIZE SPECTRUMS MORE EFFICIENTLY AS COMMUNICATIONS RUSH CONTINUES

Although one is tempted to opine for the supposed simplicity of the age of the Pony Express and the Telegraph, communications people even then were the pioneers. The task is the same -- get the information from one place to another; the means are different.

There are a number of considerations and solutions being discussed that pertain to the nitty gritty of how to use the frequency spectrum in a more efficient way and also how to package services for customers. EDP/IR here gives a brief wrapup of some of the discussions occurring at the recent Networks '80 Conference in Washington, D.C. Some topics:

- There's a need for a demarcation line between what the CPU maker and the communications carrier provide. A quick overview of modems from Bell and IBM illustrates the convergence of the elephants.

- Packet switching may not be the entire answer; a hybrid net of packet and time division switching may be faster.

- There are a number of schemes to make better use of the existing popular frequency spectrum for satellite transmission, as well as schemes to go into other spectrums. In addition, various non-satellite schemes are sprouting fast.

- A look at the known giants -- AT&T and Satellite Business Systems. SBS is now saying it expects voice to be its meat and potatoes for the near term and is also courting the medium-size user with shared facilities.

Although many at the conference tacitly acknowledged they owed their corporations' existence to the use of packet switching technology, some avowed that it does indeed have shortcomings in the inherent delays. Time division switching (TDS) technique was suggested to eliminate some of the delays. But there was little if any talk of jettisoning packet switching, as the evolution of more specific standards that promise even greater compatibility is proceeding apace.

Louis Pouzin, director of pilot projects at IRIA in France, lamented that packet switching had been seized by public networks. Pouzin, one of the early

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instigators of packet switch, said the public nets, in their efforts to satisfy the demand for speed, had buried the packet switching in layers to make it look like circuit switching. If there had been a real standard, this approach might have worked, but the rush to widespread use of packet switching while its standard, X.25, was still being formulated left the world with a "label, not a standard," he said. There was a time when it would have been possible to present packets to look like circuits based on X.21, HDLC or circuit oriented interface. "It was a mistake to sell this new service to people who wanted circuits," he remarked.

Packet switching was designed as a subsystem encapsulated within a computer system or to handle low volume character stream, he said. It is well designed for private networks -- as a component of an organization with internal logic -- but as a public network everyone tries to hide it behind layers.

Ray Sanders, chairman of Tran Telecommunications Corp. in Marina Del Rey, Calif., predicted merging of Time Division Switching (TDS) and packet switching technologies in the same network. The use of TDS can reduce the delays associated with packet switching, he said. Tran makes network processors and network access concentrators.

In a packet switching network, data is placed in groups, and each node on the network puts the packet in a buffer, reads the header, and then relabels it and sends it on its way if the data was not destined for that node. With a hybrid TDS/packet net, most of this activity is eliminated at the intermediate nodes. Use of TDS allows faster nets and also higher line concentration.

In voice applications the delay in packet switching caused by buffers at each end interferes with performance. On overseas transmissions, there is a 6 second delay -- so although packet switching works for sending voice one way, a conversation merits the term "conversational batch mode for voice," according to Dixon Doll, president of DMW Group in Ann Arbor, Mich.

Whose territory?

Becoming less prophetic and more real is Doll's plea for the CPU manufacturers and common carriers to decide on a line of demarcation relating to the various communications functions. To do their job properly, Doll urges makers to redesign their systems with networks in mind. They should axe the store and forward concept and implement schemes for fast circuit switching. Perhaps we need to revise our concept of network transparency, since we seem to expect capabilities a la ACS, which even AT&T hasn't gotten past the drawing boards. So the question evolves -- where does error control belong?

Modems Common Ground?

Network control and diagnostics have received attention by both AT&T in its Dataphone II announcement and IBM with its diagnostic modems and accompanying software. Through using new software releases and its diagnostic modems, IBM says users can:

- Establish more links between IBM computers and terminals;
- Adjust and change data paths;

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- Pass information more easily between computers;

- Put points of control anywhere in the user's network.

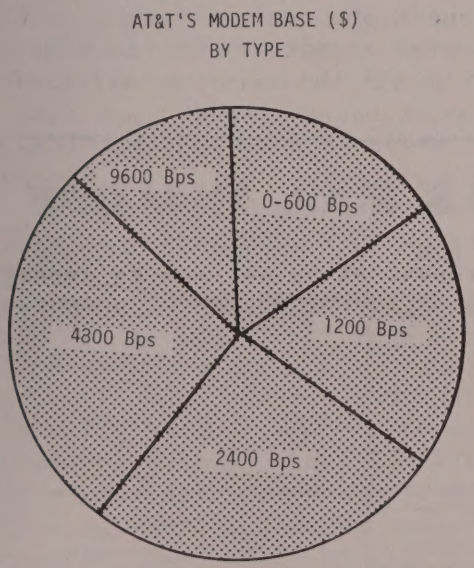
The 3863, 3864 and 3865 modems, announced last June, are said to be able to pinpoint transmission problems to a particular line, modem or device. The software handles network management tasks such as selecting separate data paths for different types of messages and organizing error statistics. These capable modems, aided by lots of communication software, represent a significant step by IBM into the area of network management.

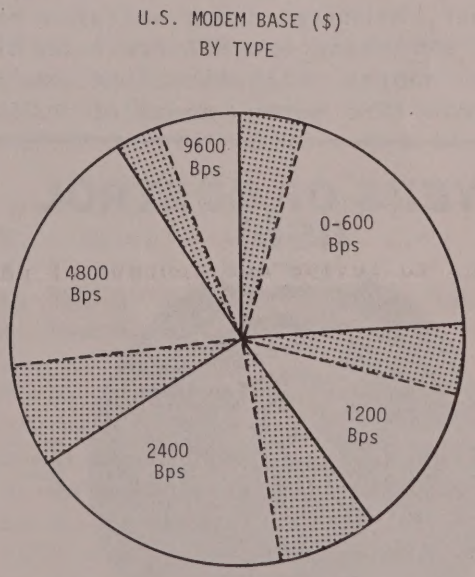
Ma Bell's Dataphone II, announced last fall and delayed in introduction, goes a step further and offers remote network diagnostics in addition to compiling error statistics and also handling tests and commands in an automatic fashion. Bell heralded the Dataphone II as a precursor for "systems to come that will be friendly, down to earth, operating in plain English, taking instruction in a natural way."

The Bell offering is hardware oriented and can be obtained in any of three levels of sophistication. The system operates on two tier hierarchy of data transmission with diagnostics underneath. On the first level of service, modems ranging from $85/mo to $195/mo provide central site control; in level two, a Diagnostic Console ($125/mo) enables the user to consolidate network diagnostics at the central site. Level three uses a Dataspeed 40/2-based network controller that issues test and command data and communicates with a Bell Test Center and costs $235/mo + $120-$160/mo for 40/2.

The Dataphone II is designed to work with satellite communications but not on any independent services.

TAKING A LOOK AT THE U.S. MODEM BASE . . .





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IBM takes lead in international standard

Another bit of irony is entering the communications arena. An international standard for synchronous terminal and front end interfaces, X.21, is being endorsed by none other than IBM, which is not noted for going the way of international standards. And on the other hand, the U.S. government has decreed that EIA 449, with 37 pins, should be the U.S. standard effective this June. However, the government may back down on that as Bell was supposed to have implemented it in the Dataphone II. The X.21 is a 15 pin, more nearly programmable interface that allows for much simpler interfaces and a reduction in cost of interfaces by as much as one-third compared with RS 232 and 366, sources say. The standard eliminates the need for the IBM auto call unit, apparently, and this could result in reductions of monthly channels costs from $140 to $50, some say. X.21 replaces RS 232 C and RS 366 and provides automatic call capabilities.

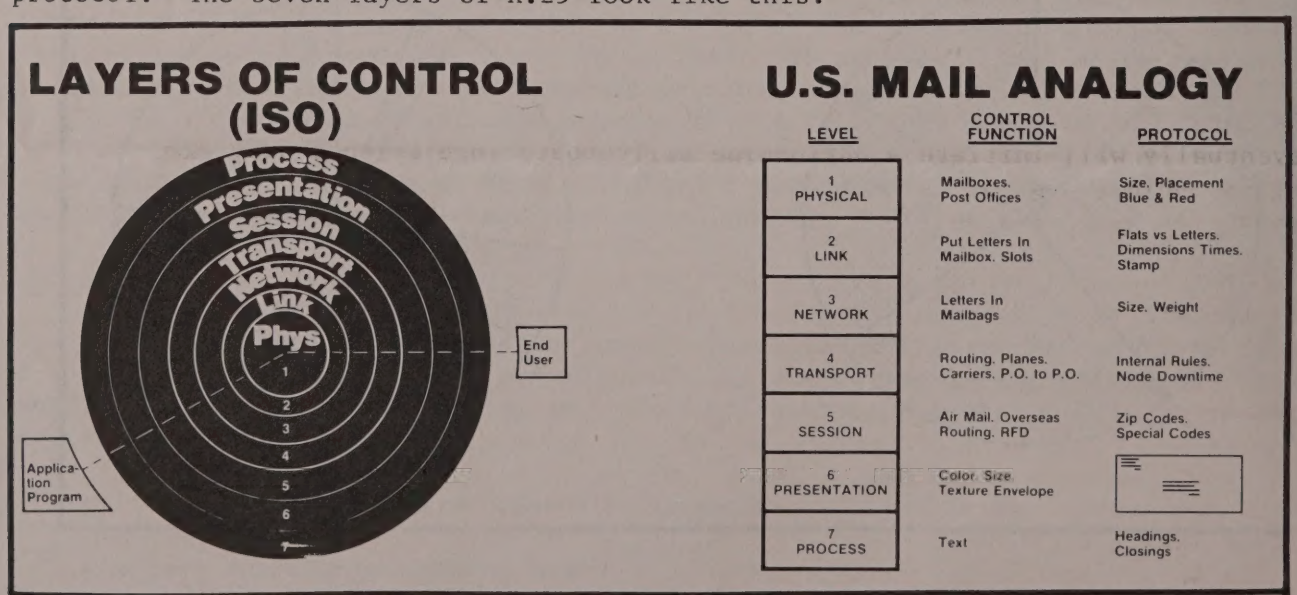
In addition, IBM has indicated it intends to make available a plug-in module for selected terminals and word processor units, thus increasing their ability message switching capability. Industry observers expect IBM will endow the following terminals with X.21:

SWITCHED		NONSWITCHED	
Date	Device	Date	Device
April, '80	3276, 3770	January, '81	3274
May, '80	3600, 3274	June, '81	3705
June, '80	3705, 8100	July, '81	3276

Prior to the IBM announcement, it was unclear whether the carriers or the vendors would take the lead in advocating this new method.

SNA -- End to End

How do IBM's SDLC - SNA and packet switching get along? They can survive together, although doing so takes more bits than one might normally want. Packet switching and SNA are each divided into layered architectures, so the user's changes to applications don't get involved in all the various layers of protocol. The seven layers of X.25 look like this:



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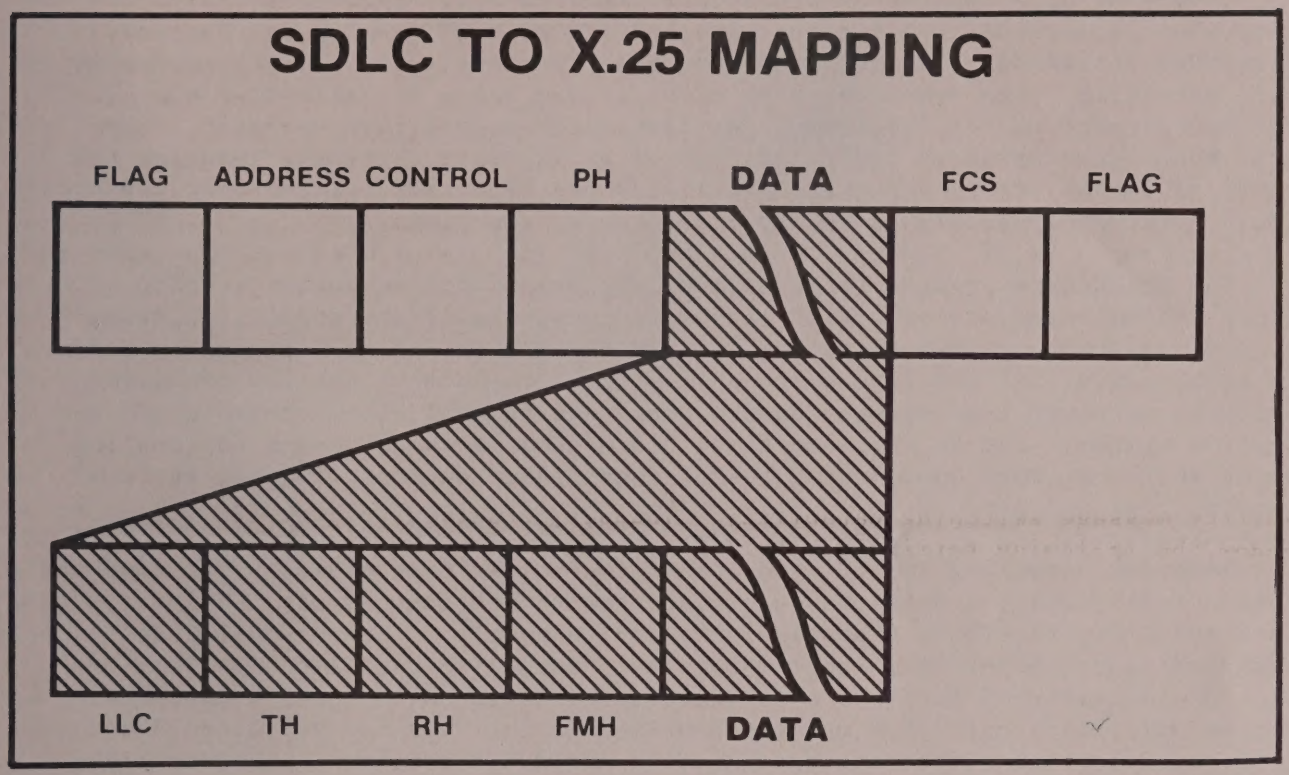
SDLC and X.25 together involve overhead, as can be seen:



As part of the question of who does what to whom is IBM's concept of end user to end user communication. Frank Backman of IBM in Gaithersburg, Md., ex- plained that 89% of the troubles encountered in communication are such items as: "Who speaks first? Is this the only transaction? I'm out of paper, etc.," and the remaining 11% are network difficulties. SNA is intended to handle the end to end type details for the customer, he said. There isn't really a conflict between common carriers and IBM, for each party concentrates on what it sees as important. The carriers focus on physical transportation of data whereas IBM concentrates on the higher level "to keep us all sane." Backman compared data with beer: "You never really own it, you're a custodian."

IBM doesn't have a monopoly on the end to end service theme. Little cousin Satellite Business System is also singing this tune, as is Ma Bell, who eventually will initiate a nationwide switchboard into which a busy executive could leave the phone numbers at which he can be reached. Hmmmm that's great for jealous wives, but can the executive also file that he's lost?

Bell's also talking about a number of services, some of which might seem to benefit Ma Bell as much or more than the consumer. Some of these are the capability to look ahead for busy signals, initially installed on 800 lines; call screening; and automatic billing, of which we're probably seeing the precursor with the longer numbers for credit cards. One will dial a longer number but won't have to talk to an operator as with a credit card call. National number calling would enable a nationwide organization e.g. AAA, to have one number that would link the caller with the nearest office. And not least is Picturephone meeting service, which has "had its ups and downs, but is on the up again, and should catch on during the '80s."

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Making More Waves from Space

It may be hard for the uninitiated to realize that space is a finite entity, but it is, and applications have been filed with the Federal Communications Commission for the last geosynchronous "parking space" allocated for a U.S. satellite. Now comes the task of splitting hairs to get better use of frequency spectrums as the demand for transmission continues unabated. Several conference speakers indicated technology is up to the task. Already the physical amount of space between satellites has been reduced, and some say use could be made of the higher and lower frequency spectrums.

The techniques to make better use of the existing frequencies involve finer transmission and reception techniques, especially the ability of microprocessors to pick a signal out of the air and process it well enough to hand it to the user. In the future, there is likely to be more sharing of bands and also narrower transmission bands, thus putting much of the onus on the reception system. But at the same time, there seems to be a demand for smaller earth stations, thus compounding the demands placed on earth station systems' capabilities.

American Satellite Corp. introduced a controller that can be programmed to automatically split a data channel into segments to carry voice, facsimile, data and video satellite transmissions simultaneously. The controller is designed to be compatible with the company's Satellite Data Exchange Service that uses small -- 5 meter -- earth stations located on the user's premises. For example, a channel that was previously used entirely for voice could be programmed for other types of transmission and would receive a narrower slice of the total available bandwidth when other higher priority types of transmissions appear. This channel would then resume its original bandwidth after the priority traffic had passed.

On the sending end, Oki Electric Industry Co., Ltd. has developed a data compression technique that should multiply the amount of information that can be transmitted by satellite. The initial application will be for transmission of TV video signals. With the new technique, a single system currently capable of handling only one TV signal will be able to transmit four TV or eight conference TV telephone signals without noticeable degradation of picture quality, Oki claims. Oki uses an orthogonal transform coding which:

- Converts the analog TV signal into a digital form;
- Divides the picture into lattice-like blocks;
- Eliminates redundant information within the blocks;
- Compares the blocks in one frame to those in the preceding frame;
- Transmits a signal based on the differences shown in the comparison.

Oki's technique will be used by NASA in an experiment to transmit standard TV signals at about 16 Mbit/sec and conference TV signals at 8 Mbit/sec.

Satellite Business Systems is talking of shrinking the size of its antennae to 13 meters and using a spot beam and regenerator and also reducing the bandwidth to 16 bits from 32.

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Ma Bell is also a big satellite fan, and thinks spot beams are the way to go. AT&T is looking at using elliptical beams that can rotate, thus covering more territory. Dynamic circuit allocation to handle busy hours for certain routings will reduce the number of ground facilities. And if one looks far into the future, there is talk, now in the experimental process, of satellite to satellite links.

RCA Americom has been in need of capacity ever since it lost its bird Satcom III. It has filed plans with the FCC to launch a replacement satellite that will have an improved system to provide in-orbit restoration of failed transponders and has asked to have higher power amplifiers. It is currently leasing capacity from others. One study done by Western Union and ITT for NASA predicted demand would exceed capacity in the 4- 6 GHz range by 1983. But if one includes the Cable TV and TV industries, those demands multiply. The orders on hand for satellite transmission capacity exceed that predicted in the study for the year 2000.

But satellites are not the only transmission medium where more capacity is sought. Microwave often carries the terrestrial TV signals from the point of origin to the earth station for transmission to a satellite. RCA Americom and RCA's Princeton laboratories are testing a system that carries two video channels within the same frequency band that previously handled one channel.

At the recent World Administrative Radio Congress (Warc), the frequency spectrum between 40 and 20 GHz was fully allocated, but more importantly, the use of wide bands was provided, although they have to be shared, according to speakers at the Networks 80 conference session on Warc.

Nor is microwave the only terrestrial method of communication that is outside the phone system. For short distances, both IBM and Scientific Radiation Corp. have devised schemes. Scientific Radiation's Model 5010-Series Optodata is an infra-red optical link that will provide two way transmission of data between terminals and other serial binary devices, controls and instruments. The data can be sent via light emitting diode over a 328 foot distance and the data rate can be up to 2400 bit/sec. A pair of transceivers costs from $395 to $455. IBM's Research Division's scheme also uses a light emitting diode as a transmitter. The system can be used between terminals and a CPU and can han- dle up to 64K bit/sec.

Almost a nontopic was the idea of non-ionizing radiation. An interim report (number 657) issued by the Geneva-based International Electrotechnical Commission, indicates there is no world-wide consensus on what levels of non-ionizing radiation in the frequency range of 10 MHz to 300K MHz constitute a hazard to mankind. Most Western countries have adopted the U.S. limit of 10 mW/square centimeter whereas many East European nations abide by the tighter USSR standards of 10 microW/square centimeter. The discrepancy seems to stem mainly because the "USSR standards are based on the possibility of any noticeable biological effect in contrast to thermal injury" whereas "most western countries have so far taken the view that major reversible effects are not necessarily hazardous to man." The U.S. limitation was also derived from theoretical and experimental considerations of the thermal energy a human body can safely dissipate when exposed to non-ionizing radio-frequency radiation.

Some vendors active in marketing DP products in Europe are discovering that foreign nations are implementing very strict standards in this area.

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• DATAPRODUCTS ADDS UNIVAC TO its stable of OEM printer companies. (IBM's already in the fold) Under an initial contract valued at about $12 million, Dataproducts will supply Univac with band printers; the contract calls for delivery over an eight year period.

• AMDAHL MACHINES CAN RUN IBM'S MVS/SE Release 2 with the use of amdahl's MVS/SE Assist Release 2 that costs $250/mo and is said to provide up to a 12% increase in throughput capacity.

• TWO PI MAKES 100TH SHIPMENT of a V/32 mini. The recipient was none other than National CSS.

• EFFORTS ABOUND TO GIVE MINIS, MICROS MORE DISK CAPACITY. The movers and shakers seem to be the disk makers and the interface folks. Here's a quick rundown of some of the action: A 3211 controller from Ball Computer Products allows a PDP-11 to attach up to four storage module drives in any mix of capacities. And Microcomputer Systems Corp.'s MSC-1088 controller ($2,650) interfaces the IEEE 488 bus to two Shugart disks storing up to 58M each. Data General unveiled an integrated disk/diskette device -- with a Winchester-type drive up to 25M bytes and the floppy for backup. The $10,200 device fits on micronovas, novas and eclipses. Corvus Systems in San Jose says its 8 in., 10M byte disk that sells for $3,690 fits on an Apple Pascal computer. In the disk arena, new shipments are starting. BASF is shipping its 26 Mbyte 8-in. disk; Shugart has begun shipments of its double-sided, minifloppy drives that use a bi-compliant head design which lends itself to production manufacture. While backup of Winchester type drives has engaged techniques ranging from floppies to a removable disk to streaming tape cartridges, there's yet another version. Corvus is pitching use of a standard video cassette. And then there are the Japanese. Priam Corp. has granted a manufacturing license for its 8- and 14 in. Winchester-type disks to Hokushin Electric Works, Ltd. of Japan. HEW will also act as distributor in the far east until it begins production in late 1980.

• NCR MAKES OWN TERMINALS in the form of the 7900 Model I, which succeeds the 796-101 made by Applied Digital Data Systems (Adds). The unit, with a 12 in. screen uses about one-third the power of its predecessor and costs the same. NCR is still marketing other 796s from Adds but plans to announce new models of its own manufacture.

• UNDAUNTED, XEROX MOVES IN OFFICE arena by purchasing Kurzweil Computer Products. Xerox, which posted increased losses on word-processing products in 1979, seems to be expanding in the office arena. Kurzweil is noted for making reading machines for the blind and optical character recognition products such as text entry devices.

• BANKING HEADS FOR THE HOME. Recently, American Express bought a piece of Warner Cable and the two-way Cable network, Qube. Now Banc One Corp., a holding company in Columbus, Ohio, (also home of Qube) and the OCLC Inc., a non-profit group that operates networks for libraries, plan an experiment that would let TV viewers make certain transactions such as paying bills, buying Treasury notes, but not deposits or withdrawals. The scheme would also provide information services. The consumer could communicate via an attachment to the VHF antenna and an adapter for the phone.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" MARCH 2, 1980 • VOL.15,NO.19 P.J. McGOVERN,PUBLISHER

USER BUDGETS TO TOP $54 BILLION IN 1980; SOFTWARE FASTEST GROWING ITEM

Vintage years seem to come in series. According to an IDC survey of 200 users, the budgets for EDP expenditures should rise 14% to a whopping $54.225 billion, with software gaining the spotlight as the fastest growing budget item, although all sectors are projected to share in the increase. And if budgets continue to grow -- even at a 12% annual rate -- in 1985 the U.S. information processing budget will be $100 billion.

Last year turned out to be even more robust than IDC forecast -- with a 16% increase in expenditures compared with the 14% predicted. IDC acknowledges that about half the difference between the forecast and the actual growth was due to that old bugaboo, inflation. But users are allocating their budgets much the same as in the past. Some observations for '80:

- Packaged software gets the award for fastest growth rate for the second consecutive year. In 1979 this category rose 33% to nearly $1.3 billion and it will again top the 30% growth rate, reaching nearly $1.7 billion. A factor undoubtedly contributing to this area's growth is the difficulty and cost of obtaining and retaining good software personnel.

- Whereas last year user spending for software/services outpaced that for hardware (including communications) -- 21% vs 16%, in 1980 spending for S/S should grow three times as fast -- 27% vs 9%.

- The most notable shifts in apportionment of the budget over the years appears within the hardware sector. There is a decrease in the percentage of the total spent on systems hardware (excluding remote equipment and communications gear) and an increase in communications expenses, including equipment. The growth rate of remote gear grew far faster, 17%, than the 9% IDC had forecast, and EDP/IR suspects the 1980 forecast of 13% may also be conservative.

- Despite problems getting and retaining good EDP people, staff related expenses as a percentage of the total budget stayed relatively stable since 1977 when it was 45.6%, and should be 46.4% in 1980.

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U.S. EDP SPENDING
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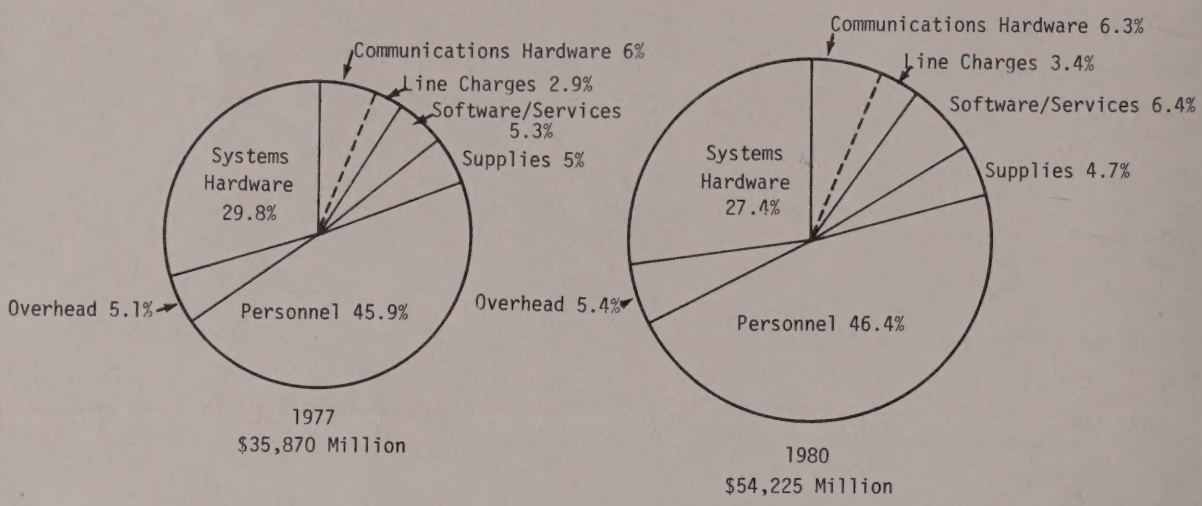

Size of users

This year's survey looked at the relative sizes of the shops and their budget plans and found a discrepancy in their 1980 growth rates. Small shops (under $500K with the biggest system typically being one of the 3/15 or 4331 ilk) expect a 19% growth. Medium shops ($500K-$2M with the largest system in the range of a 370/148)) foresee a 14% rate while large shops are looking at a 15% rise in expenditures. As might be expected, the large shops spend a higher proportion of their budgets on staff and communication than the others, while small shops allocate proportionately more to hardware than larger users.

Software expenditures also varied according to the size of the user. The medium size shop was keen on independent software packages while smaller shops showed greater reliance on manufacturers' software. Large shops spent a higher proportion of their budgets on custom software, although this was also a popular item for small shops.

Financial trends

The upswing in leasing, prompted by the introduction of IBM's 4300 and users' anxiety about the timing and the content of IBM's H series announcement, was reflected in a 6% rise in rental or lease payments to the manufacturer and a 16% rise in lease payments to third party vendors. Later in the year, Amdahl swung into the act of offering leases, and now other plug compatible vendors such as Magnuson and National Advanced Systems are also following that trend. The rise in lease/rental payments to manufacturers during 1980 should intensify as a strong trend with a 15% increase. However, for third party lessors IDC predicts only a 1% rise next year.

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U.S. EDP USER SPENDING 1977-1980
(Copyright 1980-International Data Corporation)

	1977 $M	78/77 %	1978 $M	79/78 %	1979 $M	80/79 %	1980 $M	1980 % Total
Systems Hardware (excludes communications gear below)	10,670	11	11,895	16	13,755	8	14,880	27.4
Software	1,590	19	1,895	25	2,375	29	3,075	5.7
Services	310	13	350	(1)	345	12	385	.7
Software/Services Subtotal	1,900	18	2,245	21	2,720	27	3,460	6.4
Data Entry, Data Comm. And Other Remote Equipment	2,150	20	2,580	17	3,020	13	3,410	6.3
Communications Expenses	1,045	20	1,255	22	1,530	20	1,835	3.4
Communications Subtotal	3,195	20	3,835	19	4,550	15	5,245	9.7
Supplies	1,825	10	2,000	12	2,240	14	2,550	4.7
Staff Related Expenses	16,450	13	18,620	16	21,560	17	25,160	46.4
Overhead	1,830	17	2,140	18	2,525	16	2,930	5.4
TOTAL BUDGET	35,870	14	40,735	16	47,350	14	54,225	100.0

Maintenance expenses were up 27% compared with a 17% forecast, reflecting the general across-the-board price hikes as well as selective software unbundling by the vendors.

Software/Services still a leader

Software packages, as indicated previously, is a hot growth area and it looks as though the "Not invented here" syndrome may be waning. User dollars spent on software (both custom and packages) should jump 92% between 1977 and 1980. Users expect to increase their spending for packages to nearly $1.7 billion during 1980, a hefty 31% increase compared with 1979. Software vendors don't seem to be able to keep up with the demand, as can be seen by the 1979 increase of 18% and a projected 27% rise for custom software/consulting during 1980. The packaged software growth rate could be even higher if vendors can get their products to market, thus probably grabbing some of the 27% growth expected for custom.

1980 EXTERNAL SOFTWARE SPENDING
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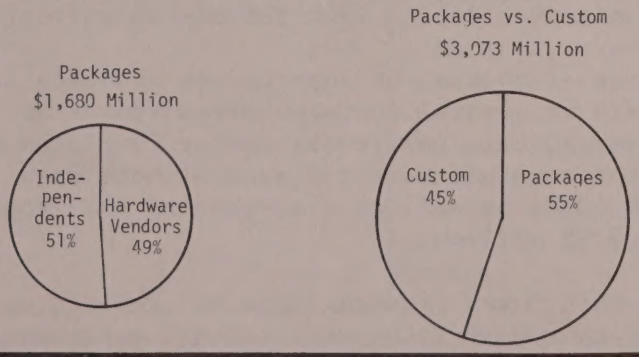

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U.S. EDP USER SPENDING: 1978-1980
(Copyright 1980-International Data Corporation)

	1978 $M	79/78 %	1979 $M	80/79 %	1980 $M	1980 % Total
Rental or Lease Payments to Manufacturer	5,815	6	6,165	15	7,120	13.1
Lease Payments to Third Party	1,805	16	2,095	1	2,115	3.9
Depreciation Charges for Purchased Equipment	2,580	22	3,160	10	3,480	6.4
Capital Expenditures for Expensed Purchases	550	60	880	(31)	610	1.1
Maintenance Charges on Owned Equipment	1,145	27	1,455	7	1,555	2.9
Systems Hardware Budget Subtotal	11,895	16	13,755	8	14,880	27.4
Data Entry, Data Communications, and Other Remote Equipment -- Not Included Above	2,580	17	3,020	13	3,410	6.3
All Hardware	14,475	16	16,775	9	18,290	33.7

One of the real challenges to the software industry is to obtain a larger share of the dollars spent on in-house development. IDC estimates expenditures for externally procured software should amount to 5.7% of users' DP budgets in 1980 -- but that's only 17% of the total amount to be spent during 1980 for software, including inhouse development.

Who gets the software dollars, which may be $3 billion in 1980 -- counting both the packaged and custom market? In spending for packages, independents have edged out hardware vendors for the lion's share of the $1.7 billion pot with a 51% share. This trend could accelerate, prompted by IBM's trend to unbundle more of its operating software. In the past several years, some software vendors have carved out healthy niches by selling their versions of IBM packages whereas IBM offered its particular utilities or systems portions free. But now with IBM charging for more of its software, the market opportunities should expand for these and other independents. And independents lead in the custom software arena also. Independents should have 57% share of the nearly $1.4 billion market during 1980 for custom software.

The services portion of central DP departments' budgets shrank last year because of the first dip in several years on expenditures for time-sharing and remote job entry. However, this particular sector is slated to resume its growth next year and the combined services area of both data entry and computer output microfilm (COM) as well as time-sharing RJE should see a 12% growth during 1980 to $385 million.

One must remember that these figures in no way reflect on the growth of the services sector as they only illustrate the MIS department spending, not that of the various departments which comprise the industry's bread and butter.

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The predicted growth of user spending for the combined software/services sector is a strong 27% for 1980 reaching $3.46 billion and garnering 6.4% of the budget, up from 5% in 1977.

Communications -- hard to decipher

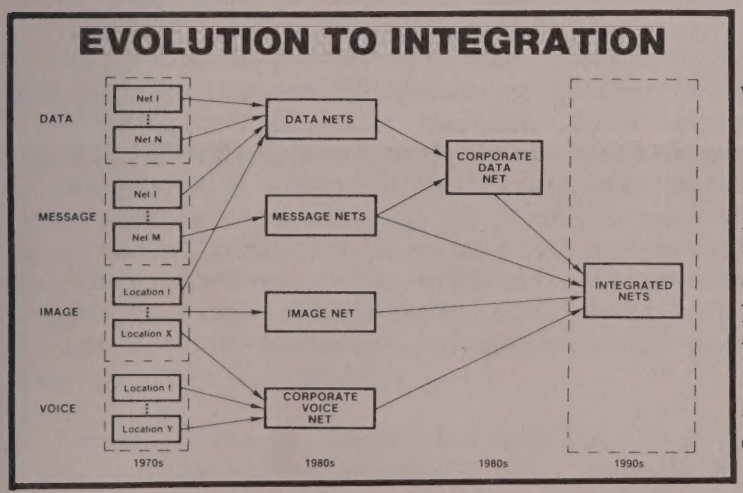
Communications is steadily consuming more of the user's budget. For 1980, IDC estimates users will spend nearly 10% on communications items vs nearly 9% in 1977. IDC sees the growth rate of spending on communications slowing to 15% from the 1979 rate of 19%. But EDP/IR thinks the 15% rate estimate is low, as was the previous estimate of 11.7%.

Looking at the growth rates of the two subsectors, line expenses and equipment, the communications or line expense item has been posting an annual increase of 20% or more since 1977, while equipment seems to be slowing down from its high of 20% in 1978. The allocation of the expenditures for line expenses and for equipment appears relatively stable over the years with equipment consuming about 65% of the communications expenditures.

Part of the problem in measuring the growth of communications hardware, which includes data entry, data communications and other remote equipment, may be that some DP departments are placing the expense of this gear under various user department budgets. Thus the survey may not reflect the total dollar volume in this category.

There's not much question that there will be increased use of communications by businesses, and the area of data communications may become more difficult to measure as the evolution proceeds into the information generation wherein the office is much more automated and electronic mail is much more common. Underlying this statement is the foregone conclusion that digital networks will become pervasive.

EDP/IR sees the PABX supplier, be it Ma Bell or upstart Rolm, in a superb position to act as the catalyst to integrate local communications facilities and functions such as data, fax, text and voice. And after the user is hooked on this way of life, to offer the same capabilities to other points outside a particular office.



The value added networks, which are now supplying solutions to problems of incompatibility among various terminals, can expect to maintain a healthy growth as the demand to communicate with incompatible equipment continues. Further out on the horizon are services such as those proposed by Satellite Business System, scheduled to launch its satellite in October, Xten, and others.

AT&T insists that its Advanced Communications System, although very delayed, is still very much alive.

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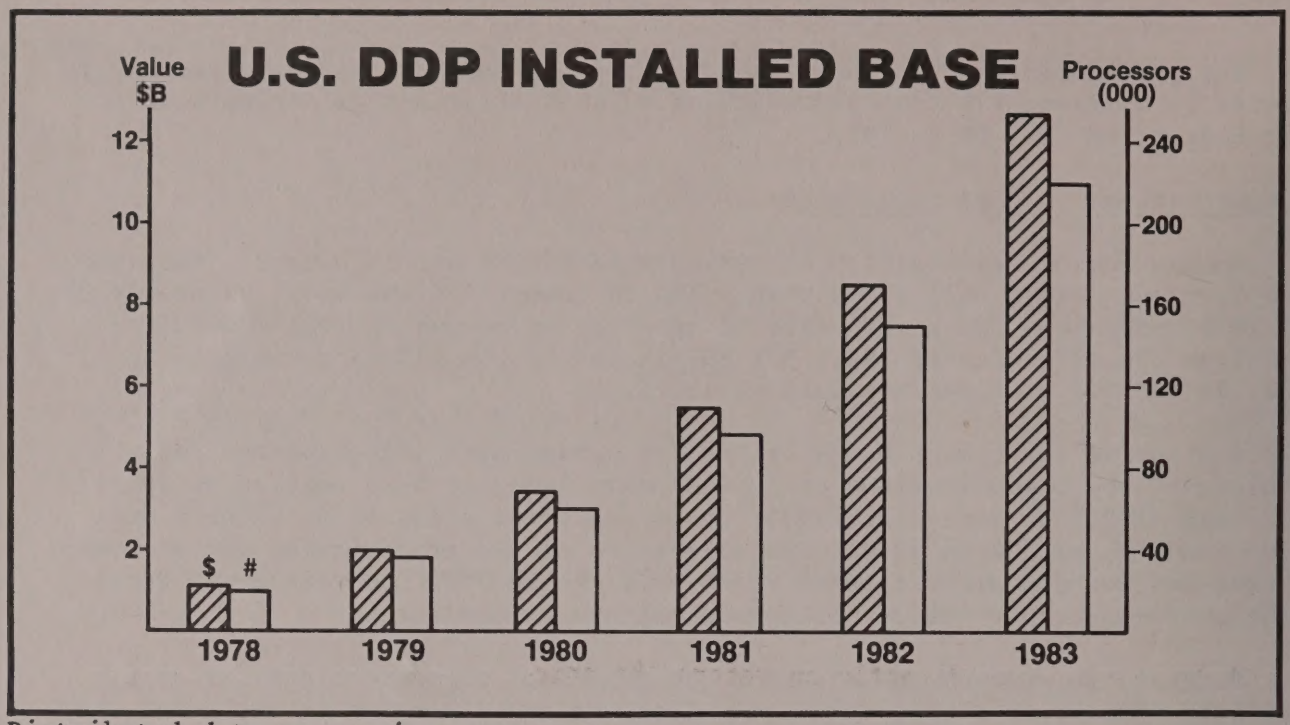

Distributed data processing

No longer a buzzword, distributed data processing is growing apace. The DDP market reached $2 billion in installed base in 1979 and should grow to no less than $12 billion by 1983, including minis, small business computers and processing (intelligent) terminals. By the end of 1983 there could be as many as 220,000 processors at operating nodes within DDP networks in the U.S.

An IDC survey of 25 large organizations using DDP found that many have created a new position, a liaison between users and distributed data processing department. In addition, the level of involvement of the user, DP manager and liaison person has risen significantly.

Skinnier lines

IBM CREATES GENERATIONS OF E BEAMS

To be in the very large scale integration (VLSI) game, the widths of paths for electrons on chips have to be skinny in order to pack lots of gates on a chip. And the current definition of a skinny line is 3 microns or so, while there is talk of capability and requirements in the sub micron arena. Although in reality man may in fact be able to create the technology to actually fabricate such lines and to solve problems such as cross talk etc., the real limiting factor in the progress of VLSI may be man's ability to deal with complex designs. In fact, man is turning increasingly to his ally, the computer, to design and fabricate smaller, more complex computers. Many of the papers at the recent IEEE Computer Society Conference (Compcon) in San Francisco focused on the design problems of VLSI.

While some vendors are out in front of the pack with their 3 micron capability, a few are clearly on the leading edge. And the implications of what IBM can do with its various generations of inhouse designed electron beams are staggering. We'll probably see it in bubbles as well as circuits.

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IBM uses the electron beam to write patterns, under computer control, directly on wafers. The giant has evolved the master slice process that lets it put gates on chips and then place them in stock. Later, it uses an electron beam device under computer control to write patterns directly on the wafer, thus allowing for faster production of various types of chips.

The E Beam at IBM has already gone through several iterations, and the latest seems so sensible to a photographic darkroom amateur that one wonders at the evolution at IBM. But the results are clear: capability to leave clear impressions of a variety of types.

Here's a simplified view of what IBM is doing in E Beams, as taken from a presentation by C.L. Ting of IBM, who observed that his lab can make lines slightly over .01 micron, but semi technology really isn't ready for these yet.

IBM started with a vector scan system that gave very sharp corners and operated under simplified computer control. An improved version was built with an advanced electronic column that offered much better density and could use a simple type of resist. This was good for masks but was not economic enough to use writing directly on wafers, he said.

The next step was the direct spot system, which uses square images and can write 25 times faster, theoretically. The squares prove advantageous in corners, he said. IBM has four of these installed working in a pilot line manufacturing mode.

The square image device is fine for 2 microns but is difficult if one wants 2.2 microns, he explained. In order to give flexibility, IBM designed one with a large and smaller square images adjacent to each other. The lab is building prototypes that provide 1 micron size lines, he indicated.

And for further flexibility, which might be needed, for instance, in bubbles, there is a prototype machine that allows selection of various shapes, such as squares, circles, semi circles, etc.

Thus it looks like IBM can certainly be counted among those to be in the forefront, although Western Electric and others are undoubtedly also devising their own fabrication techniques.

MASS STOR MAKES FILES COMMUNAL FOR DIFFERENT CPU BRANDS

Mass Stor, a Sunnyvale company founded by Erik Salbu, inventor of Ampex's mass storage tape system, has developed a concept for a custom designed product that enables different brands of mainframes to use disks belonging to the other kind of CPU in an installation. For instance, if there are Univac and IBM CPUs and disks, with the aid of the Mass Stor system each can access the other's disks. Furthermore, the Mass Stor system will dynamically allocate data to the proper storage device, making the decision whether it belongs on a mass storage device or on disk.

The concept uses the CPUs' data base management systems, so cannot properly be called a DBMS system, but it does comprise a CPU subsystem dedicated totally to retrieval and storage of data. Mass Stor uses an IBM compatible CPU that is larger in size than those manufactured in this country.

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• MORE PCMS FOLLOW LEASING TREND. National Advanced Systems (NAS) and Magnuson Systems are each offering short term leases, thus moving to further capitalize on user uncertainty regarding the H series and long lead times for 4300s. NAS offers a short term lease, said to be about 30% below IBM prices, on its AS/5000, which competes with the IBM 3031. Floyd Kvamme, president of NAS, said it makes sense for a large company to hold its own lease paper and noted that Itel, from whom NAS picked up its installed base and maintenance and marketing force, did not hold its own paper. With the lease plan, NAS plans to improve its cash flow over the long term. NAS plans to use the inherent capabilities of parent National Semiconductor to "technologize the architecture" of IBM-type systems. The acquisition of Itel's base and its skilled people enables NAS to devote its efforts to technology because the other elements are already in place. National Semi certainly has had its share of false starts entering the computer business -- first with the System 400 that was a 370 look alike that never was shipped and then with plans for a DEC compatible mini that was scratched because of legal hassles. So National bought its way into the industry via Itel. Kvamme observed that the Itel maintenance business was profitable and would have been a good buy even without NAS' plans to enter the business in a larger way. In the future, Kvamme expects IBM and NAS to address the issue of operating systems for multiprocessor systems.

Magnuson offers the option of converting from an operating lease to a financing lease without penalty. With first shipments beginning in October, 1978, at the end of 1979 Magnuson said it had over 50 systems installed. About 75% of its systems were installed as IBM replacements; about 10% were new systems and the rest were additions. Magnuson, which recently picked up its first OEM contract, with Storage Technology Corp., sees its systems going into dedicated niches such as I/O controllers and library catalogue systems.

• IT'S NO SECRET THAT MERGER ACTIVITY was up in the computer industry last year. And W.T. Grimm & Co., which keeps such statistics, tabulated a 7% rise in mergers in the computer manufacturing and services field in 1979 vs 1978. The industry's 7% increase far outpaces the U.S. average of a 1% rise. The computer field managed 88 mergers, of which divisional or partial sales accounted for 24 compared with 30 of the 82 mergers in 1978.

• THE EXXON BANDWAGON ROLLS ALONG. Exxon Enterprises increased its stake in Periphonics from 80% to 100%. Periphonics, known for its voice response systems, also makes front ends and inexpensive point of sale devices used primarily in check cashing and credit authorization applications. Zilog, an affiliate of Exxon Enterprises, has announced special purpose processors for its Z8001 and Z8002 microprocessors. Each Extended Processing Unit (EPU) expands the Z8000 instruction set by more than 256 instructions. The units are designed for such CPU-intensive tasks as floating point, data base operations, graphics and network interfaces. Zilog seems to be joining the trend toward awareness of the importance of specific applications orientation with its appointment of Stephen Walters to a new position as applications manager for component design engineering.

• THREE PACKET SWITCH CARRIERS AGREE ON BISYNC protocol, thus allowing easier use. The carriers are GTE Telenet, Kokusai Denshin Denwa Co., Ltd., the overseas telecommunications carrier of Japan, and Datapac's operator, TransCanada Telephone System.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" MARCH 12, 1980 • VOL.15,NO.20 P.J. McGOVERN,PUBLISHER

Mountain Ranges of Products

WHITHER AND WHEN H? SPECULATION ABOUNDS AS IBM-WATCHING BECOMES VARSITY SPORT

IBM-watching takes various forms, and can be either dignified by fancy names or denigrated by terms such as rumor-mongering. Whichever view one takes, there is undeniably a frenzy of activity as users and vendors alike attempt to make plans in order to accommodate or counter whatever the Giant may or may not divulge from Armonk.

In fact, IBM-watching is a big draw for conferences these days, and a section on IBM strategy is nearly de rigeur. IDC recently held its Briefing Session with a section on IBM, while Advanced Computer Techniques Corp. (ACT) focused on IBM in a couple of sessions at its Future Systems Forum.

It has long been voiced that there will be another series from IBM, called the H, and the scenarios differ more in form than substance. Here are some of the issues and answers being espoused today:

- When will H be announced?
  * Anywhere from St. Patrick's day, 1980 to 1981, Most votes expect H toward the end of 1980 or perhaps the beginning of 1981. EDP/IR is also in this camp. Some see the H as a bridge machine with a new version of MVS and masquerading as a 3035, with an announcement date anywhere from St. Patrick's Day through the forthcoming second quarter. Two 4300s are expected on the day of the green.

- Will H architecture differ from the 30 series?
  * The predominant suspicion is Yes, but that it will be software compatible with the 303X series.

- Will the price/performance ratio be as great an improvement over the 303X as the 4300s were over the 370?
  * Unlikely.

- If and when IBM comes out with relational data base management system for its large machines (the 38 beat the big guys to the punch here) will users be able to keep their investment in IMS?
  * Overwhelmingly Yes. This answer comes to EDP/IR straight from a

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couple of IBMers' mouths. The unanswered question is whether the relational scheme will be imposed over or under IMS.

- Will IBM allow its forthcoming disk to be attached to any 303X? *Probably. But there is some disagreement whether it will go on the 3033, as EDP/IR believes, or on the N which will be the bridge to the H series, as some say.

In areas of more certainty, H will probably conform to these trends:

- Higher percentage of cost for software. During 1978 and 1979 IBM users spent about 8% of their budget for software and this could easily grow to 26% in the 80s, IDC predicted.

- Use a new, high speed big disk, alias Whitney or Coronado.

- IBM will endorse the "building block" approach.

Of course, then there is the outnumbered voice that mutters advice that one shouldn't hold one's breath for H; there has been some rethinking at Armonk. According to this source, the disk will be introduced in April and require a 3M byte/sec channel, which IBM will also provide.

Whatever line one takes, it is clear that there will be a lot happening in 1980, if only in the amount of speculation spent on what IBM will do next.

Mountain ranges of products

If good news can be equated with a range of product introductions, IBM has lots of good news, if ACT is correct. There should be a new series introduced each year except 1981 for the next four years. The timing of the announcements and range of power in millions of instructions per second (Mips), according to ACT's H Series Forecast study are:

- H or Adirondack in late 1980; Mips range from 3 - 27;
  This long-awaited series of seven processors will have the longest time span of announcements, ranging from the third quarter, 1980 to first quarter 1982. The last to be announced will be those in the 15- 27 Mips range that are pegged as the follow ons for the 303X.

- G in 1982; Mips range from 1.5 - 10;
  This series, also with seven models, is slated to fill the gap between the E and the H series, and be announced between the first quarters of 1982 and 1983.

- Sierra in 1983; Mips range from 10 - 50;
  The follow on to H, the Sierra's five models will be announced between the first quarter 1983 and the first quarter 1984.

- Olympia in 1984; Mips range from 0.3 - 1.7.
  This is a follow on to E, with all three models unveiled in fourth quarter 1984.

The order of the product introduction is not straightforward, but there does seem to be a pattern. For instance, the Es will fill the gaps with the

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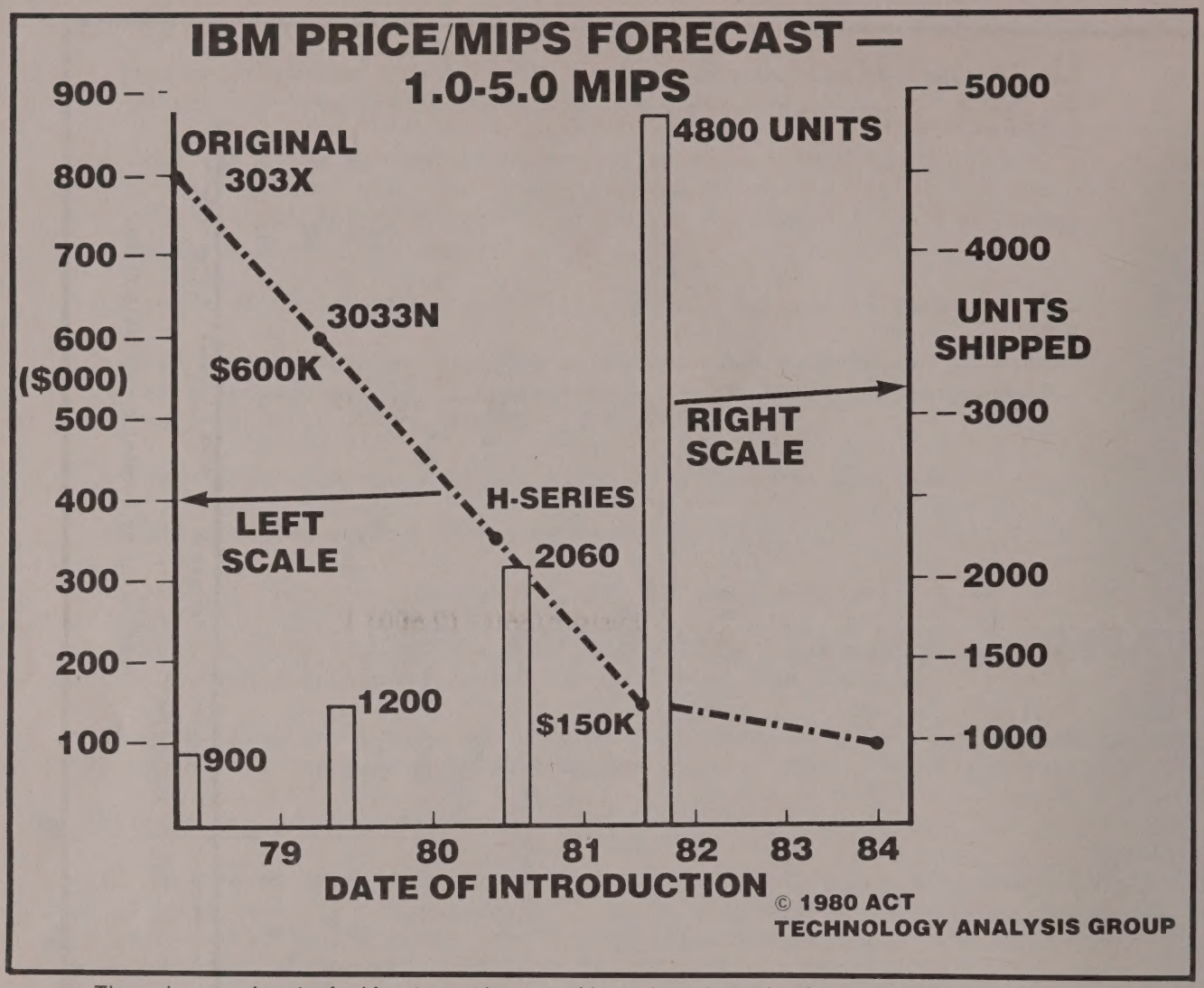

The above chart indicates the predicted price decline for the 303X series and the resultant increase in the number of units IBM will have to ship in order to keep revenues somewhat comparable.

4336 and the 4351. The next announcement, the H, as well as the G, will begin in the midrange, then the smaller units, with the largest units last. EDP/IR thinks it likely that these systems may be on the boards at IBM but that the Giant will reduce the number of products actually introduced. Perhaps we'll see no more than 75% of these. The schedule looks somewhat optimistic in terms of production capability and market demand, but then again, the Giant has been adding acres of plant space lately and there is no telling what overhead users are going to have to endure for new systems that conceivably will be more user oriented.

If IBM follows this scenario, some of its systems would be barely cold after announcement, and barely delivered, before the "follow on" will be announced. Clearly if IBM intends to keep up this pace, it would seem the Giant would likely be planning to make purchases very attractive to eliminate the spectre of leased machines coming back to roost.

Another possibility is that if purchase is not overwhelmingly attractive compared with lease, IBM might discontinue the downward trend of price/performance. This would somewhat inhibit H users, for example, from rushing to

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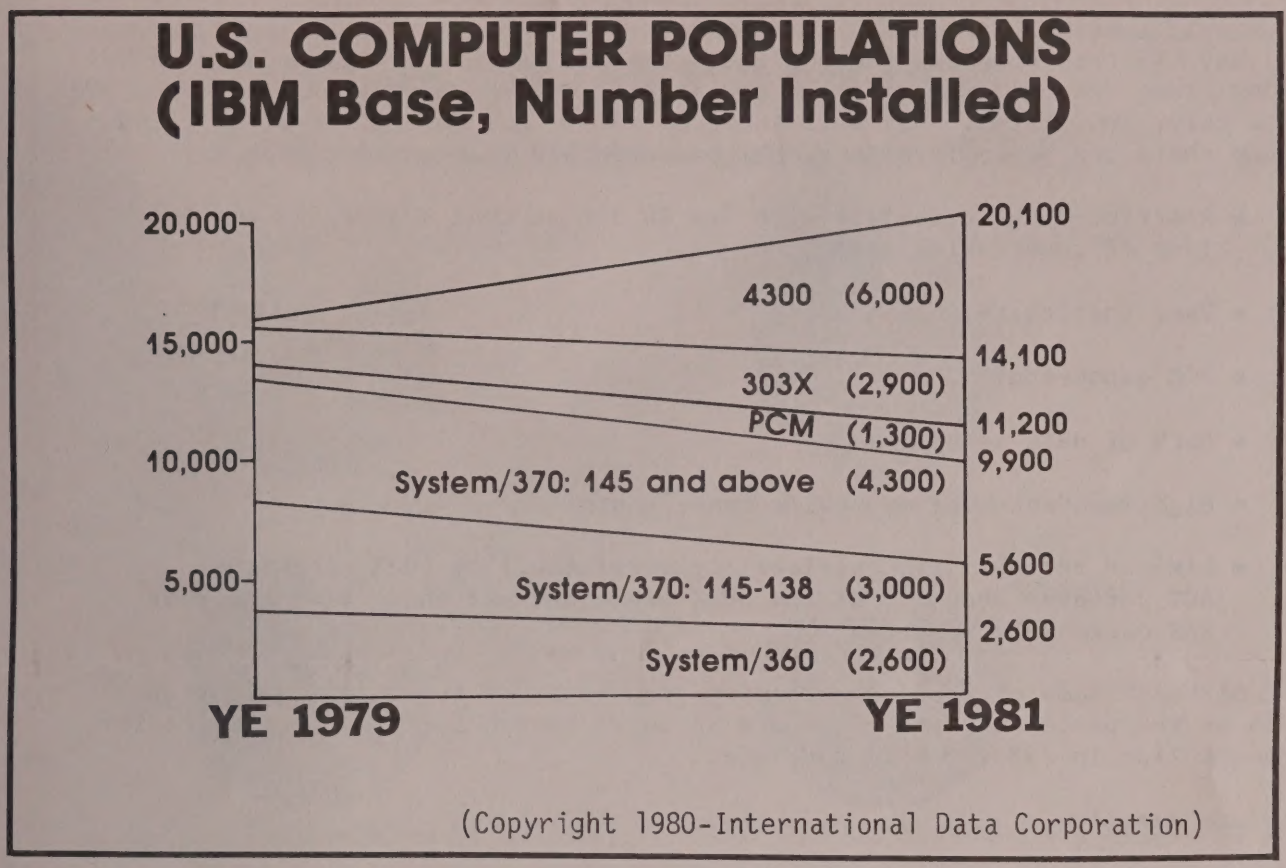

trade in their Hs for the Sierra systems. But that is hardly a likely scenario, as the chart from ACT indicates.

A distinguishing factor between the E series and the H is that E will remain DOS whereas H will be MVS, IDC predicted.

Possibly there will be a new operating system this summer, which may act as a bridge to the H series. The "son of MVS" will most likely be able to handle multiprocessor configurations. Bearing in mind the problems IBM had introducing the System 38, which included new architecture and software simultaneously, an argument can be made that IBM will proceed in phases. The new version of MVS would run on the forthcoming bridge 30 and perhaps other members of the 303X, IDC indicated.

With its building block approach, H may be oriented toward multiple processors and enable the user to add dedicated processors such as a data base machine or perhaps a front end SNA machine. Perhaps the data base machine could support IMS in one mode and in its native mode be a more sophisticated machine, in a fashion similar to the 4300s which can run 370 mode and the DOS/VSE mode as well, IDC suggested. Some of the user options for logical or physical functions could be:

- Data base machine;
- User interface;
- MVS operating system;
- SNA machine.

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Why the theory we won't see H until the end of 1980 or beginning of 1981? Among other reasons, IBM has been making engineering changes on its dense, 500 gate chip, IDC stated. Why will there be an H? Bob Fertig, VP of ACT, indicated there are several reasons, all based on 370 inadequacies such as:

- Restricted extensibility with its 24 bit virtual addressing and lack of associative memory;
- User complexity;
- PCM expansion;
- Lack of data security;
- High manufacturing and maintenance costs;
- Limited reliability, availability serviceability (RAS) features. ACT surveyed about 30 of the 303X users and was shocked at the poor RAS users were reporting.

Although some of these shortcomings can be fixed by evolutionary steps such as the paste on approach, there is ample reason for IBM to obsolete its product line in 1980, Fertig concluded.

Storage details

The H will have 32 bit addressing, permitting the user to address up to 4 billion bytes of on-line storage, IDC predicted. There's little doubt we'll see more of the hierarchical storage approach, and this is what EDP/IR sees as one of the biggest mysteries that will be divulged with the real Hs. Will IBM use its 256K charge coupled devices (CCDs) that it hasn't been saying much about? And where? As a drum replacement or in context with a disk? In either case the independents have broken ground, although admittedly not with 256K CCDs.

And will the 3880 controller announced with the 3370 disk on the 4341 be bundled back into the processor box? There isn't much external to the System/38, and EDP/IR expects that's a trend. Will the 3880 be a back end storage processor or part of an integrated data base management system?

There's little doubt the 3880 has potential. Fertig labeled it a 5 Mips box. Only about one quarter of the box is full, and there is room for two more controllers, for a total of four, IDC indicated.

The area of strongest disagreement between IDC and ACT is the timing of the Whitney disk. IDC indicated there has been some problem with the thin film head on the already announced 3370, so IDC doubts IBM would want to announce the new disk with long lead times and thus impact what IDC sees as a strong order position for 3350s. However, ACT expects a first quarter date and at least one industry source expects an April announcement.

The Whitney disk should nearly double the price performance of the 3370 and weigh in at around 5,000 bytes/$, according to IDC. It won't be available on the 3031 or 3032. Then further out, in the first part of 1982 there will be the McKinley disk, with 2 billion bytes, ATC forecast. Goodies coming down

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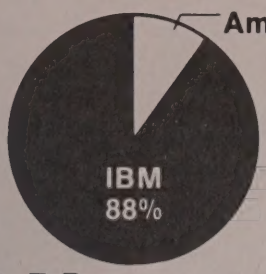
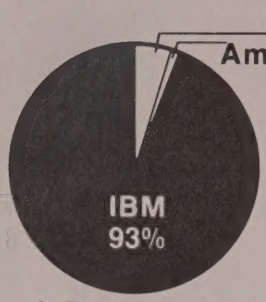
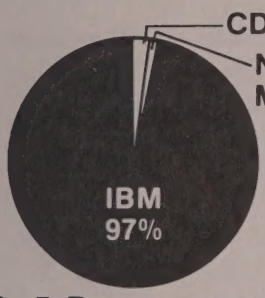
PCM PENETRATION
(U.S. Market Data - Units at YE79)



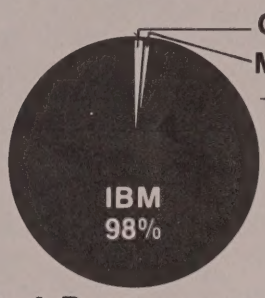
S.C. 7 Processors (n=1540)



S.C. 6 Processors (n=3502)



S.C. 5 Processors (n=3017)



S.C. 4 Processors (n=6043)

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the pike from IBM in 1980 include a successor to the 370X front end processor and another version of the 3850 mass storage system, in addition to the Intrepid streaming tape device to be used for backup to the disk systems. Further out are such goodies as a file processor, the 2 billion byte disk, dubbed McKinley, according to ACT. IDC also sees a lower range 3800 page printer, perhaps with cut paper.

PCMs and the Japanese are of concern to IBM. The IDC charts above show PCM penetration in various size classes. A quick review of Japanese activity in the U.S. shows that Fujitsu owns 37% of Amdahl; Fujitsu has just signed with TRW for a joint venture in the U.S.; Hitachi is again onboard to supply National Advanced Systems (Itel's successor) with large systems. In addition, Japanese semiconductor technology is gaining widespread admiration for its high quality and advanced technology content. Ironically, U.S. vendors including IBM, are discovering the advantages of the Japanese production because IBM has contracted for such volumes of 16K chips that it has sent itself as well as others scurrying to the Japanese for supplies. A Japanese firm recently previewed a 256K bit chip.

IDC size class four includes the 4341, 370/138 and others of comparable performance; size class five includes the 370/148; class six includes the 3031 and 3032 while seven includes the 3033.

Although EDP/IR fully expects at least the 4336 and 4351 on St. Patrick's Day, this issue at least shows that IBM-watching is alive and well.

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• MA BELL LIKES THE IDEAS OF INTEGRATION AND SERVICE and has its eyes on handling the local loop needs of businesses as well as expanding services available to the home. VP Roger Moody told the Future Systems Forum that Bell is planning a raft of product introductions, many of them with uniform nationwide pricing and is moving to longer term leases.

Bell looked at the terminal industry and discovered its 40/4 on a monthly lease was only hitting 15% of the market. AT&T filed with the FCC to offer its 40/45 on 90-day, 2 and 4 year plans. Looking down the road, Bell is trying to devise ways to move the function of providing computer capability to the user, just as it did when it made the population telephone operators. This may come about not with its giant ESS switches but perhaps with onpremise systems, part and parcel of Advanced Communications Service, which he said will come someday. In the meantime, Bell has had to revise ACS's architecture, update the technology and "has pumped in experienced development people," Moody said. Bell initially underestimated the market for ACS, he added.

Bell has become a marketing oriented company, Moody said, and has gone from 1974 when it took 7.5 years between conception to installation of a product --"a timeframe normally associated with geologists" -- to turning out the Dimension system in 20 months. The trick in this industry is not so much the technology itself but how to package it, he indicated. The uniform pricing and long term leasing mood is aimed at IBM, which he said is already Bell's biggest competitor. The 40/4, he added, is a "Chinese copy" of a 3270.

Moody said Bell is looking at the mass of wires within a building for such varied tasks as phones, dictation, word processors, security, terminals, remote units, etc. as a piecemeal setup waiting for a solution. "In the long term we're in trouble if we confine ourselves to voice and data," he said, remarking on the opportunities with electronic messages. Moody also depicted a scenario whereby Ma Bell could use its paths to link up home security and fire alarms to other locations. For instance a fire alarm could trigger the fire station, the police to clear traffic, and a neighbor to make sure occupants are out of the house, he said.

• MAGNUSON LANDS PACT WITH STORAGE TECHNOLOGY for about $10 million of its CPUs. The contract is Magnuson's largest OEM contract. Could it be that STC is coming out with a back end storage processor? STC's 1978 annual report mentions a Virtual Storage System that uses solid state and disk technology, data management software and a processor.

Speaking of back end systems, the world is still waiting to see the fruition of Intel's acquisition of MRI Systems, which many expect will be a data base management subsystem. MRI recently put its System 2000/80 data base management system on a 4331.

• NCR CONTINUES TO BEEF UP ITS software for transaction processing. In January it improved Tran-Pro by adding modules that free programmers from procedural tasks such as formatting, editing, data validation and routing. Now comes Tran-Quest, which is said to make data base inquiry and management more user transparent on the V 8000s. Priced at $14K or $312/month, Tran-Quest is said to provide a "format-free" query system that allows users to pull out infomration via simple codes.

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EDP industry report

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"THE GRAY SHEET" APRIL 14, 1980 • VOL.15,NO.21 P.J. McGOVERN,PUBLISHER

Amdahl and Storage Tech merge -- Page 8

VALUE OF MINI SHIPMENT VALUES GROWS 27% IN 1979

"The market is fraught with opportunity," Paul C. Ely Jr., vice-president and general manager, computer groups, Hewlett-Packard Co.

The value of U.S. based manufacturers' minicomputer shipments grew 27% in 1979 to $3.8 billion, including add-on peripherals, and should continue at 27% annually through 1984 when minis will account for nearly one third of the total processor shipments by value, according to IDC. The value of shipments from the top five manufacturers of minis -- DEC, Hewlett-Packard, Data General, Honeywell and IBM -- all grew at a rate of 30% or better in 1979.

Given the above rate of growth, it is easy to see the logic behind Ely's statement. In some respects, the challenge of growth -- especially the rapid growth being experienced by many DP companies -- can be just as great and as perilous as the challenge of surviving in a barren marketplace.

As minimakers grow and the market demands mature, they find themselves starting to act like the big guys -- with emphasis on end user needs, particularly service and applications software. Thus there can be a profound change in the source of revenues. And such changes aren't necessarily smooth for some companies. DG's earnings growth hiccupped in the first quarter of fiscal 1980, and the company cited the expenses incurred in shoring up and enlarging its services strengths.

Although the market is expanding, with seemingly room for all, there has been a good deal of acquisition activity within the last year. EDP/IR sees the mini industry in its third era.

- In the beginning the mini was a bare bones tool, sold primarily to OEMs. Makers didn't provide much handholding, software, or service.
- Next came the supermini, which brought the vendor in closer contact with the end user.
- Now mini makers are facing the same concerns as mainframers -- demands for service, applications, and better systems programs.

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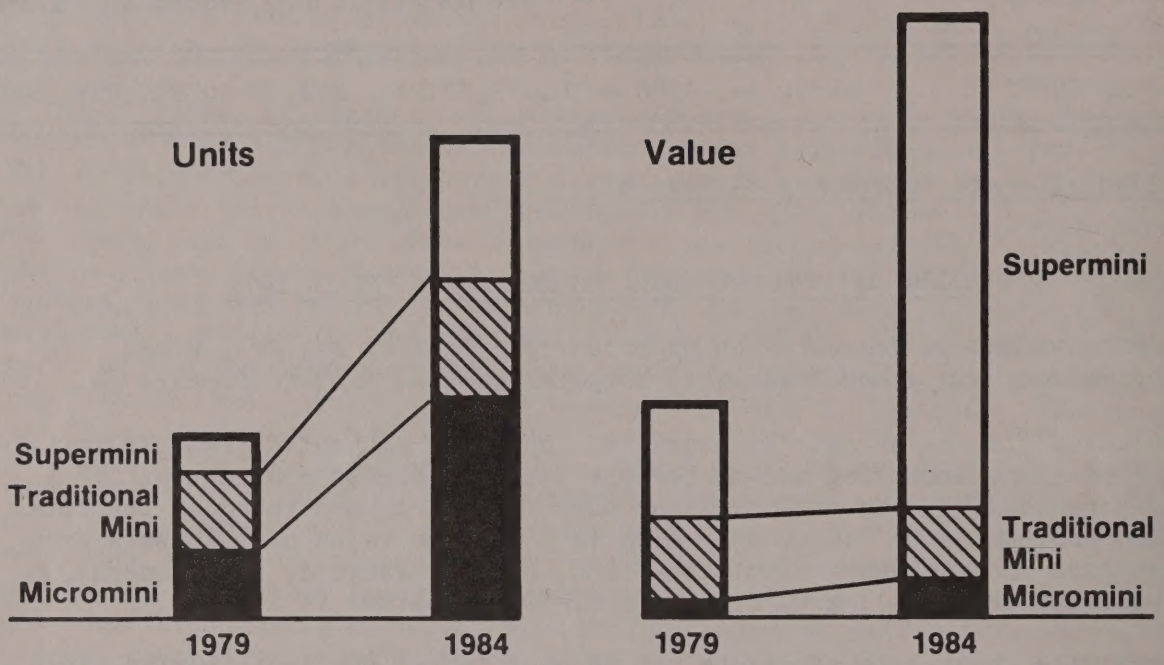
MINICOMPUTER SHIPMENTS
By Size Class



The above chart shows the growth in supermini and micromini shipments IDC anticipates through 1984. In terms of number of units shipped, superminis should be the fastest growing portion of the mini arena over the next five years, increasing at an annual rate of 33%. By value, superminis will account for 82% of the total minicomputer shipments in 1984, up from 55% in 1979.

Micromini shipments, although growing at 26% through 1984, will represent only 6% of the value of minicomputer shipments in that year. Traditional minicomputers will grow only 4% annually by number as they are attacked from above and below by the supermini and the micromini.

IDC's definition of minicomputer is based on marketing rather than hardware parameters. Minis are sold primarily as tools and not solutions. They are available as complete systems although they may be sold as boards only. Minis are marketed to OEMs as well as to end users and generally carry quantity discounts. They are also generally sold and not leased.

In this third era of minicomputers, vendors are required to do some sophisticated long range strategic planning to position themselves in future markets. No longer is the sole challenge turning out a sufficient number of boards or no-frills systems. Of course, the mini makers' task is not made any easier by the relative scarcity of certain components such as 16K RAMS.

The advantages of vertical integration, all the way back to the semiconductor stages, are becoming increasingly evident and may ultimately be the

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demarcation line between those that survive independently and those that don't. Inhouse semi production can ensure a flow of components in short supply in the industry. But more importantly it offers the manufacturer the advantage of a truly integrated systems design, optimized for specific tasks. Hewlett-Packard, Digital Equipment and Data General all have semi facilities.

Revenue Mix Changes

Last year was a significant year for the minicomputer arena as several trends that had been growing finally crystallized to form the third era. For instance, the primary reason for the relative success of the larger vendors was the increased contribution to their revenues from services, add-on peripherals and software. Basically these firms were utilizing their installed bases to generate revenues.

MINICOMPUTER REVENUES 1979 ($ MILLION)
(Copyright 1980 - International Data Corporation)

DEC	HP	DG	Honeywell	IBM
$1,850	$750	$540	$250	$200

The above revenues are those calculated by IDC as attributable to the companies' minicomputer operations. IBM moved into fifth place this year.

A quick look at the growth of various sectors of some of the heftier minicomputer companies shows service and other revenues outpacing equipment sales and/or overall revenues. For the six months ended Dec. 29, 1979, DEC's service and other revenues grew 39% while equipment sales grew 25%.

And Data General's first quarter service and other revenues showed a 55% gain over those of the year ago period while first quarter total revenues were up about 31% compared with those of the year-ago quarter. But DG's first quarter earnings only inched up 1.7% over the corresponding year-ago figure, reflecting in part DG's efforts to switch from the hardware business to that of a more rounded enterprise offering more service and software. For instance, DG's system engineering and service engineering forces grew 21% and 27%, respectively, in the first quarter 1980 vs the same period a year ago.

HP TARGETS MANUFACTURING MARKET

In 1979, Hewlett-Packard's computer revenues topped $1 billion for the first time. With rampant growth a distinct possibility for a company such as Hewlett-Packard, HP has decided to funnel its efforts into areas in which it thinks it can develop a leadership position and fully support its products. HP, with its typical low-profile approach, has selected the manufacturing market as one of the primary targets of its computer-related products that span the range from desktop computers to the top-of-the-line 3000.

HP comes not as a stranger to this market, with all its instrumentation background. This, along with its line of DP products, most of which have the common thread of the Image data base, puts HP in a good position to provide a wide variety of products to the manufacturing market. (HP recently announced versions of Image and its Query language on the top-of-the-line desktop computer, the 9845. Also, 9845 now has synchronous 2780, 3780 communications.)

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HP feels its blend of technology is stronger than that of IBM and its business emphasis is stronger than DEC's. The market is big, unsaturated, and HP understands it, according to Edward McCracken, general manager of the General Systems Division, which makes the 300, 300 and 250. Manufacturing companies also usually procure more than one computer. HP's goal is to be the alternative to IBM for distributed data processing in the manufacturing market.

Perhaps part of the reason for targeting its markets is HP's feeling that the main growth in the marketplace is yet to come. McCracken sees 1980 as an "inflection point" when things will really take off, and maturity in the market won't be reached until around the year 2000, so "it's very exciting for anyone in the small end of the market." By 1990, nearly all computers will be priced under $100,000, he observed.

One of the reasons for growth is that old tried and true principle of elasticity. McCracken expects his division's products can cost 30% less per year with equal performance, barring inflation, so in 10 years the cost could be down by a factor of 10 or more. And the demand will be there as business attempts to boost productivity while people costs soar about 10%/year. Thus in 10 years, people costs could be up by a factor of two or three while computer costs are down by a factor of 10.

In line with the predicted demand for small systems, HP doesn't plan to develop any system costing more than the 3000 series 33, which has a top price around $300,000. R&D expenditures are above the industry average and focused on specific products. The company probably spends as much as anyone on products priced under $100,000, McCracken said. He plans to expand the OEM program dramatically this year and next; this area is even more crucial when systems value falls below $50,000, he said. Currently between 30% - 40% of 3000s are distributed through OEM channels.

Reading between the lines, EDP/IR advises close watching of the 300. It basically has the potential to be a superset of the 3000, although it has not been endowed with quite all the software capabilities. It has a new operating system, compatible with the 3000's but is RPG oriented.

To court the manufacturing market, HP is providing its own applications software. Of GSD's 1980 R&D budget (which is 13% greater than 1979), 70% will be for software tools, including very table oriented manufacturing applications that can be customized without touching source code. HP has booked over 30 large 3000s with manufacturing applications. In areas other than manufacturing, HP normally refers customers to a list of approved software houses. Ninety-five percent of GSD's R&D is on solutions to manufacturing company problems; about 50% of marketing and sales are also spent on this area.

Recently HP unveiled 3270 communications for the 3000 II or III, and enabled HP terminals to directly access IBM-type hosts. HP had peer to peer communications long before IBM condoned the idea. HP has shipped over 3,500 of its 3000 series and now ships about 150 units per month. The average systems price is $200,000, as the peripherals and terminal content continues to rise. HP tries to keep the cost of peripherals under 15% of the system price. In 1979, the GSD unit doubled its revenues to about $400 million.

In addition, the Desktop Computer Division in Fort Collins, Colo., churns out small CPUs, many of which are suitable for upgrades to paper tape numeri-

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cal control systems throughout a plant. HP's Data Systems Division produces the 1000 series of minis as well as the 2240 control processors.

HP's philosophy encourages entrepreneurism by keeping groups and divisions relatively small. Thus it is not surprising to find many of these divisions scheming how to improve their bottom lines in their individual P & Ls by such techniques as boosting OEM sales. Here are some gleanings from EDP/IR's whirlwind tour of four plant sites in three states in two days:

- HP is looking at entering the text processing marketplace, with both improved printers, perhaps ink jet and laser, and processors and terminals. Remember, HP has made a name for itself in easy to use business graphics.

- HP's Disk Division is eager to increase its noncaptive business and is targeting the plug compatibles and others as possible markets for future disks planned in the range of 100M bytes and larger. The disk division has thin film work ongoing in its labs.

- HP plans a new 3000 each year for the next five years, each more powerful and less expensive than the current 3000s. In addition, it also plans more 300s as well as software and communications enhancements. GSD's software thesis is based on compatibility with the 3000 series. Software has a five year development cycle and a 20 year marketing life whereas hardware has a three year development period and three year marketing life.

Here's a breakdown of HP's Computer Groups operations under Ely:

- Computer Marketing Group
  - Field Sales Offices
  - Computer Support Division
  - Consumables, Marketing Communications

- Computer Peripheral Group
  - Disk Memory Division (7906, -20, -25)
  - Boise Division (2608 line printers, tape drives)
  - Vancouver Division (2630 Series printers and printing terminals)

- General Systems Division (HP 3000, 300, 250)
  - Commercial Systems (Boeblingen)

- Technical Computer Group
  - Desktop Computer Division (9815, -25, -35, -45)
  - Data Systems Division (1000, 2240 control processors, test systems)
  - Cupertino IC operation (SOS)
  - Boeblingen Calculator Division (Desktop Computers)

- Data Terminals Division (2640, 2621 series CRTs)
  - Grenoble Division (3070, 3075 data capture terminals)

Where do computers rank in HP? Quite high.

- Electronic data products (technical and business computers, personal calculators and peripherals) grew from 25% of sales in 1970 to 45% in 1979, outweighing test and measurements in 1979 for the first time.

- HP's revenues from the EDP portion grew 42% between 1978 and 1979, from $810 million to $1.147 billion. Of this, the business DP

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component was 36% and technical 50%, handheld calculators 9% and peripherals 5%.

- HP recently combined its computer and calculator groups and split them on the basis of market. Thus Fort Collins' calculator efforts are now the Desktop Computer Division, allied with the Technical Computer Group.

HP doesn't exactly have a reputation for expeditiously positioning its products in particular markets. Quickly reviewing HP's efforts in the DP arena, Paul Ely is said to describe 1967 to 1972 as six "years in the wilderness" which included getting started, bringing out the HP 1000 and designing the 3000. When Ely moved into that part of HP in 1972, there were three years of consolidation, trying to get the 3000 to market. HP freely acknowledges the machine was "introduced somewhat prematurely." But the concepts of distributed data processing and virtual stack architecture were introduced at HP. Since 1976, HP's computer operations (GSD or EDP) have had four very good years in a row, with a growth rate averaging over 40%/year, with 1979 quite a bit higher, McCracken said.

Now the 3000 has a specific target, and the smaller 250 and 300 are getting their paths plotted.

Shipments of the 300 began eleven months ago, and it is now being targeted at the office computer area, competing with the IBM 34 in the small business arena. Gerald Peterson, marketing manager for the 250 and 300, admitted that until eight months ago, HP had not focused the 300 as well as it could have, and that he feels this is the right place for it. HP will position it for price competition vs the 34.

The 250 was developed at Fort Collins in the Desktop Division but its manufacturing and marketing have been transferred to the General Systems Division in Cupertino. This standalone system with Basic language is being offered to OEMs for marketing in the small business computer arena. HP has established a network of about 250 OEMs worldwide for this product and the "effort is cranking up" after two years, Peterson said.

HP is also equipping the 250 with manufacturing applications, with the expectation that the OEM will modify the software. Applications are priced at $7,500 list and the OEM can make copies after obtaining one license. The hardware discount to OEMs is around 25%. There are over 1,000 250s installed worldwide, half of which are in the U.S. Volume shipments started about a year ago. An additional market focus for this system is as a workstation.

Vertically Integrated

As may be surmised from all the divisions, HP makes a lot of its own peripherals and components. One of the keys to the CPUs -- of all shapes and sizes -- being introduced these days is the customized logic capabilities made possible through its inhouse semiconductor facilities. After silicon on sapphire (SOS) fabrication technology got a black eye when General Automation ran into trouble with its outside supplier, HP alone kept doggedly on the trail and seems to be reaping the rewards. HP's clean room facilities are equal in size to those of Mostek, making it the fifth largest in the U.S., HP said. SOS chips are used in the 3000, 300, 250, 1000 L Series and desktops.

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Traditional Minis

HP hasn't forgotten its traditional mini business -- Technical contributed 50% of EDP revenues. Vertical integration is evident in its latest announcement of the 1000 L-Series, which has as its heart three SOS chips: a 16-bit CPU, an I/O processor located on every interface board that creates "distributed intelligence" architecture, and the HP-IB interface. The L series single board processors are about half the price of the former least costly 1000s -- board prices are $2,250 vs $4,450. They are available as boards, rack mountable processors or as systems.

Speed is emphasized, as well as low cost. Direct memory access is possible via the I/O processor, and the instruction set is a subset of that on the 1000, optimized for operations between memory and registers. Overall I/O bandwidth is greater than 2.7M byte/sec. HP indicated that networking capabilities and data base management software are being developed. While a product in its own right, the L finds its way into the Intelligent Network Processor (INP), a controller that handles such functions as protocol processing, buffer management, etc.

Marketing Thrust

HP plans ahead on both tactical (short term) and strategic (long term) levels. While it has hired salespersons from the competition, it has also made a strong effort to grow its own, which is a sign of maturity in this industry. It is hiring MBAs and for its customer and systems engineering forces, and the plan is that these people, after exposure in the field, will supply future management talent.

PRIME DESIGNS AUTOMATED OFFICE SYSTEM
FOR MANAGEMENT, ADMINISTRATIVE LEVELS

Prime Computer is taking the integrated systems approach with its Office Automation System that pays special attention to the needs of managers -- because that's whose time is most valuable. The approach emphasizes Prime's evolution to an end user orientation.

The system is the first from a minicomputer vendor that takes a holistic look at the functions performed within an office and the vehicles needed for a smooth information flow. Prime cited studies that management spends about 70% of its time communicating; the system is designed to expedite these types of chores. The software elements are compatible with the Primos operating system and Prime's networking capability via X.25. Prime expects as many as 60 users on a system, and cited $8-10K/station -- the price of some WP-only systems. The company anticipates users will install its 550 or larger CPU.

The system includes three principal software elements: management communication and support, $15,000, which includes electronic mail, document distribution and calendar scheduling; advanced text management (one user maintained 60K word dictionary), $10,000, that handles proofreading, word-for-word translation and automatic hyphenation. Menu approach word processing, $15,000, has moves, cut and pastes, etc. There are different terminals for management and administration -- $2,600 and $4,800. OCR and business graphics are on the enhancement list. Prime may find its third quarter schedule a bit ambitious, but it will have more features than Wang's Wise, which has yet to appear.

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• STAMDAHL? STORADOL? Whatever moniker Jesse Aweida and Gene White come up with, one thing is for sure, the combination of Amdahl and Storage Technology Corp. (STC) makes this outfit the foremost provider of a one-stop shopping alternative to IBM. Sixty percent of Amdahl CPUs have STC peripherals. And it could be that the combination firm might be big enough to trigger the Giant's threshold of tolerance. Revenues in 1979 of the two companies totaled $56.9 million, excluding Amdahl's other acquisition, Tran Telecommunications Corp., which was privately held. Amdahl has been on a shopping spree the likes of which are almost unparalleled in the industry. Within about three weeks it bought Tran, which has some interesting circuit switching technology (EDP/IR Feb. 20) and makes concentrators and nodes for switched digital networks, and recently an agreement to merge with STC. But the binge probably isn't over, because Amdahl still doesn't have a front end, which it was seeking in Comten and then again in Memorex.

There's more synergy in the pact than may appear. Not only does this give Amdahl -- and STC -- an assured market should IBM change its channels as it might with rumored new disk and tape devices, but STC also has a communications group, which is focusing on voice communications. An obvious target of synergy and cost effectiveness is field service and marketing. Jesse, entrepreneur extraordinaire, managed to emerge as chairman of the board and chief executive officer, with Amdahl's Gene White as deputy chairman and John Lewis as president and chief operations officer.

Amdahl's been spending a lot of shares -- the value for Tran depends on the price of stock at the time of the deal, but could go as high as 1.35 million shares maximum -- around $26 - $27 million. And for the STC merger, Amdahl holders will get one share of the new company for each Amdahl share while STC holders will get three quarters of a share -- for a total of 38 million shares. Interestingly, Fujitsu's 28% share of Amdahl dissipates to 14%, but it will, as in Amdahl, be the largest single shareholder. Steps needed to finalize the pacts are Tran shareholders' approval and board and shareholders' OK by STC and Amdahl.

• WHERE'S GENE AMDAHL? He's on consultant status at Amdahl and is a director of Grid Systems, a startup operation of which he's a director. President is John Ellenby, formerly manager of advanced programs at Xerox's Palo Alto Research unit who headed the project that put an office system in the White House. Grid's other founders are "in the woodwork," and the firm is seeking financing. It plans to make an office related product.

• AND SOME FOLKS FROM PRIME HAVE SPUN OFF in a venture called Apollo Computer. Founders include Bill Poduska, a founder of Prime and formerly vice-president of R&D as president, and VPs Dave Nelson, of VAX fame and director of research at Prime, and Mike Greata, director of advanced systems development at Prime, as well as an as yet anonymous fourth, who has been at Prime but more recently elsewhere. The group has 10 people at work on a system that is to use the capabilities offered by VLSI in a highly networked set of dedicated (per person) CPUs. Intended for distribution via systems houses, the new product will be aimed at professionals, engineers and programmers. Workstation or CPU costs should be in the $20,000 ballpark. Taking a page from Prime, the founders say this system really has software first. While vague, they indicate Unix will have a strong influence on system design. Financing has been procured -- more than $1.6 million for the first year and definite plans for second round financing, rumored to be about $4.3 million.

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EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" MAY 23, 1980 • VOL.15,NO.22 P.J. McGOVERN,PUBLISHER

VLSI LURES DESIGNERS TO CONCEPT OF INDIVIDUAL COMPUTERS WITH HIGH BANDWIDTHS

The saga of the computer industry is about to encounter yet another type of design, prompted by temptations presented by very large scale integration (VLSI) and the requirements of features such as graphics that are now considered desirable rather than luxurious.

Currently, designers of such systems are struggling with terminology to differentiate their products -- or schemes -- from the current monikers such as small business computers, personal computers, desktop computers. The concept is primarily architectural in nature and thus may become pervasive through a raft of products in various markets, such as small business, desktop, and those earmarked for distributed processing. But in another respect, the forthcoming products could result in a different pattern of usage, with users having their own individual CPUs. These systems will also likely become engines in office automation gear as well as their role as CPU for the professional computer user. It's too soon to tell what the effect on the market will be, but certainly it's the beginning of a trend worth watching.

The common denominators in such systems will be the single unit's ability to handle a respectable amount of processing on site, a sizeable amount of microcode available to the user and large bandwidths with possibly separate busses and processors to provide extensive graphics capabilities. Many will incorporate a very modular approach. Most of these systems can be expected to be easily networked to form a variation on the distributed processing theme. Enter the booming new era of local networking schemes. Some systems will be designed to share global memory, such as University of California, Berkeley's tightly coupled multiprocessor X-Tree, while others will be self sufficient but capable of swapping data and files very rapidly.

Designers are talking about small, very fast systems ultimately using chips with memory, logic, and switching functions onboard one chip. But perhaps more important than speed, which the minicomputer and other areas of the industry have found is no longer necessarily the key selling point, is the potential for additional capabilities such as detailed graphics -- either color or gray scale. Thus far, EDP/IR hasn't heard of anyone touting that such sys-

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tems will have better human interfaces in terms of language, but hopefully that will come. With the increased emphasis on graphics, companies are investigating better interface schemes than simple joysticks.

Some of the companies are coming from university backgrounds, some from minicomputer spinoffs, and some from the semiconductor arena. Although much of the session on personal computers at the recent IEEE computer conference in San Francisco focused on universities' efforts, the trend has already spread to the commercial world -- Three Rivers Computer Company plans to introduce its Perq product this summer; Apollo has been formed by some former Prime people; and others such as Zilog and its spinoffs have their roots in the semiconductor industry.

A key ramification of this trend is increased emphasis on local networks. Three Rivers takes what it says is a cost-effective approach by using Cable-TV components -- coax with CATV connectors -- and a packet switching scheme similar to that of Ethernet except that it has a collision avoidance algorithm instead of collision detection.

Rationale of systems

The Laboratory of Computer Science at Massachusetts Institute of Technology (MIT) is preparing "for the gradual and orderly transition from its current dependence on centralized multi-user time-shared machines to an eventual network of 'personal' computers providing for virtually all of the Laboratory's computation needs," according to Steve Ward.

Alvin M. Despain of the Computer Science Division at the University of California, Berkeley, observed that "the computer systems of the future will consist of a network of personal computers and central resources with shared programs and data. Communication costs will remain relatively expensive, even as computation becomes inexpensive."

Xerox's Palo Alto research center has designed and built the Dorado, which is intended to accommodate both the flexibility of handling four high level languages simultaneously and the requirements of high bandwidth I/O devices such as color and gray scale displays, according to Gene McDaniel.

Howard Wactlar of Carnegie Mellon University commented: "We are entering a new world of versatile personal computers, as different from the world of time-sharing as that world was from batch processing."

By looking at what is being concocted in research centers and universities, one can project what types of products should be available within the next couple of years. As VLSI circuits become available, the products' capabilities will increase. But the systems' architectures are being designed with the future circuits in mind.

The X-Tree system uses a tree scheme rather than ring or other architecture because it allows a larger number of nodes on a high bandwidth. The X-Tree has separate communications hardware, although eventually it may become an integral part of the single-chip computer, Carlo Sequin of Berkeley observed. "The total amount of circuitry required to build a complete communication switch is nontrivial and may rival the amount of logic hardware in the actual processor attached in this node. This simply confirms the often

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heard opinion that the real problem of the next decade is not computation, but communication."

A routing controller at the switching node protects the processor at each node from constant interruptions.. With the speed inherent in VLSI, the time-multiplexed switching bus can "operate at chip-internal speeds which can be an order of magnitude higher than external signals," he said

Xerox's Dorado has 4K of microcode; the processor initiates a new microinstruction every 50 nsec; the paged virtual memory has a cache and pipelined data control; and an instruction fetch unit (Ifu) supports prefetching and decoding of byte opcodes for different languages, Daniel explained. The processor, memory and Ifu are heavily pipelined for fast execution. The Ifu "fetches and processes opcode bytes in parallel with processor execution, and the memory system can deliver data to the processor at full memory bandwidth when all goes well in the cache."

Dorado's architecture can be expanded to accommodate future memory advances -- it can have up to 28 bits of virtual address, 4 Mword of 16-bit storage; and up to 16K of high speed cache. Currently it has 1 Mword of storage, a 4K cache, 22 bits of virtual address, and 640 Mbit/sec storage bandwidth. There are separate data paths into storage for fast I/O devices, such as a color display, that don't tie up the processor, he continued.

MIT is taking the building block approach to such a degree that it expects users will be able to go to a supply room and check out additional memory, busses or graphics processors as they are needed and plug them into their systems' backplanes, Ward said. The architecture follows the "Tinkertoy" principle that every plug fits every socket, he explained. The basic element of intermodule communications is called the NuBus.

Although the system now offers what are considered "lavish" bandwidths (about 100 Mbit/sec) and addressing capabilities, these can be further expanded through a possible multiple bus structure. "We view the bus dimensions not as an upper bound on communication capacity but as the basic unit in which it is packaged: data path widths and bandwidths may be arbitrarily extended, for example, by means of parallel NuBus connections," Ward explained.

To facilitate transparent performance improvement by addition of extra hardware, such as graphics or floating point processors, there is direct NuBus communication between a program and optional devices.

Interestingly, document handling and distribution, electronic mail and word processing chores were specifically identified by two speakers: Ben Rosen of Three Rivers and Wactlar of Carnegie Mellon University. The CMU scheme, for which the university is seeking a manufacturer, would be adept at handling such office-related chores since CMU has found that its community of users spends about 8% of its time on such tasks. The CMU Scientific Personal Integrated Computing Environment (Spice) would go further than others regarding human interfaces with its plans for voice I/O. Shared files would facilitate the office-type work.

Three Rivers' Perq uses a microprogrammed CPU whose native instruction is P-Code (the Pascal intermediate code). One of the requirements of the system

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was that it be able to manipulate documents as well as the top-of-the-line word processors. "Most users spend a majority of their time manipulating documents -- memos, reports, letters, programs and manuals," Rosen said.

FCC RUBBER STAMPS MARKETPLACE REALITIES WITH ITS COMPUTER INQUIRY 2 RULING

The Federal Communications Commission in its second Computer Inquiry has opened the competitive door to all computer-based communications services and on-line terminal equipment. But it reserved the right to keep a close rein on AT&T and GTE by restricting their offerings of "enhanced" or computer-based communications services and terminal equipment to separate subsidiaries. In addition, the two firms will have to tariff transmission facilities for their enhanced services. The transition time for the two carriers is two years.

The FCC's decision (Docket 20828) adds clout to Harvard Professor Anthony Oettinger's term "compunications." For several years, since 1966, the FCC has been struggling with defining a demarcation line between computers and communications and who can offer what to whom. AT&T has been calling end runs around the decree by applying the term "enhanced" services or debating the technical merits of what might be considered offending products.

Actually, the broader issue of what Ma Bell may and may not do is a lot older; the 1956 Consent Decree with the Justice Department, still extant, precludes AT&T from participating in the computer market. It's not clear what will happen regarding the Consent Decree, and the decision takes some wind out of the sails of efforts to rewrite the 1934 Communications Act.

Although there will be some adverse reactions to the ruling -- AT&T is already muttering about going to court to fight the separate subsidiary portion and GTE will likely join in -- the overall industry reaction may well be one of relief after the fine print is available for scrutiny. But at least the rules are known -- even though the lines aren't drawn, and players will be able to plan.

The previous state of affairs was a two edged sword -- just as AT&T was in theory not supposed to offer computer related products, firms expanding from their computer industry scope into communications had to deal with an unfamiliar regulatory world embodied by the FCC. Some parts of the decision:

- All carrier-provided terminal equipment will be deregulated. Thus the Dataspeed 40/4 and the newer 4540 can take off their cloaks and emerge with all their grandeur in the enhanced 3270 terminal market. AT&T, along with its Teletype subsidiary, ranked seventh in the U.S. 3270 market as of year end 1979 with about 3% of the installed U.S. base.

- All carrier provided terminal gear must be unbundled and offered for sale by March, 1982.

- All network services must fit into either basic -- offering voice and data transmission capability -- or enhanced -- combining basic services with computer processing. And only basic transmission services are subject to regulation. Only GTE & AT&T need to have separate subsidiaries for regulated and unregulated activities.

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GENERAL-PURPOSE COMPUTER CENSUS

Counts in the General-Purpose Computer Census are based on the best information available to IDC -- but are estimates nevertheless. Computer makers, as a rule, do not directly supply this type of data. General-purpose computers -- as characterized by IBM's 370, 303X and competitors -- comprise the bulk of digital computers by value. They are primarily character or byte oriented and programmed in higher-level language.

Instead of being pegged to constantly shifting average values, size classes are based on currently marketed IBM products and other manufacturers' models that compete with them, e.g., a computer in Size Class 7 would compete with an IBM 3033 or 168. (Other classes can be checked under IBM's column.) Note that many mainframe manufacturers also offer smaller systems that are included in the Small Business Computer Census. An "X" in the last column means none on order from the original manufacturer.

AS OF JANUARY 1, 1980

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
Amdahl	470V/5	6	$ 65,000	9/77	35	30	65	X
	470V/6	7	95,000	6/75	125	47	172	X
	470V/7	7	102,000	9/78	47	32	79	70
	470V/8	7	117,000	9/79	10	5	15	80
	Total				217	114	331	150
Burroughs	2/3/500	3	6,600	11/61	250	195	445	X
	1710	2	2,700	8/72	850	470	1320	X
	1720	3	7,200	2/73	500	280	780	X
	1815/25/30	2	3,100	5/77	240	320	560	200
	1855/60/70/85	3	6,400	5/77	770	250	1,020	250
	1905	2	2,700	12/79	10	-	10	300
	1955/85	3	5,000	12/79	10	-	10	350
	2500	4	10,400	2/67	22	40	62	X
	2700	4	11,000	8/72	280	165	445	X
	2800	4	11,100	12/76	210	125	335	) 200
	2900	4	12,100	12/79	10	-	10	)
	3500	4	19,000	5/67	210	225	435	X
	3700	4	26,000	11/72	285	260	545	X
	3800	4	17,100	4/77	160	75	235	) 130
	3900	4	18,600	12/79	2	-	2	)
	45/4700	5	33,000	10/71	305	125	430	X
	4800	5	32,500	9/76	160	75	235	100
	5500	5	35,000	3/63	22	10	32	X
	5700	5	33,000	12/70	3	5	8	X
	65/6700	6	66,000	11/69	145	110	255	X
	6800	5	46,100	6/77	140	95	235	) 100
	6900	5	57,000	6/80	-	-	-	)
	7700	7	130,000	8/73	49	24	73	X
	7800	7	124,000	11/78	4	2	6	25
	Total				4,637	2,851	7,488	1,655
Cambridge	1600	3	3,600	1/79	10	-	10	25
CDC	Omega 480-1	4	12,800	6/77	60	-	60	5
	Omega 480-2	5	13,700	8/78	50	-	50	25
	Omega 480-3	5	14,000	1/80	-	-	-	40
	Cyber 170-720	5	37,000	5/79	8	6	14	30
	Cyber 170-730	6	53,000	6/79	10	3	13	20
	Cyber 170-750	6	113,000	8/79	3	2	5	10
	Cyber 170-760	7	145,000	4/79	2	-	2	15
	Cyber 71	4	21,000	7/76	5	9	14	X
	Cyber 171	4	28,000	8/77	18	42	60	X
	Cyber 72	5	42,000	10/71	13	42	55	X
	Cyber 172	6	51,000	7/75	29	44	73	X
	Cyber 73	6	61,000	3/72	20	35	55	X
	Cyber 173	6	80,000	9/75	10	38	48	X
	Cyber 74	7	116,000	3/72	23	15	38	X
	Cyber 174	6	103,000	9/75	14	20	34	X
	Cyber 175	7	14,700	8/75	21	37	58	X
	Cyber 76	7	184,000	3/72	7	8	15	X
	Cyber 176	7	187,000	1/78	6	2	8	3
	G-20	4	19,300	4/61	1	-	1	X
	1604	6	41,000	1/60	5	-	5	X
	31/3150	4	9,700	12/64	43	18	61	X
	3170	5	22,500	12/70	15	17	32	X
	3200	4	14,700	5/64	25	16	41	X
	3300	5	34,500	9/65	77	42	119	X
	3400	5	23,500	11/64	3	1	4	X
	3500	5	31,000	1/69	29	10	39	X
	3600	6	49,000	6/63	13	10	23	X
	3800	6	60,000	12/65	12	1	13	X
	6200	6	42,500	11/70	-	3	3	X
	6400	6	63,000	5/66	39	26	65	X
	6500	6	86,000	12/67	15	12	27	X
	6600	7	116,000	8/64	38	21	59	X
	6700	7	140,000	7/70	3	-	3	X
	7600	7	191,000	1/69	20	7	27	X
	Star 100	7	280,000	12/74	4	-	4	X
	Cyber 203	7	250,000	11/80	-	-	-	2
	Total				641	487	1,128	150
Cray	1A	7	205,000	4/76	9	4	13	9
	1S	7	125,000	/81	-	-	-	1
DEC	2020	3	6,900	7/78	125	75	200	150
	2040	4	10,900	6/76	80	50	130	5
	2050	4	20,000	5/77	90	50	140	20
	2060	5	21,500	7/79	30	10	40	80
	PDP-6	4	10,000	10/64	3	-	3	X
	1040/50	4	17,300	10/67	130	85	215	X
	1060/70	5	21,500	6/72	115	105	220	X
	1080/90	6	31,000	6/75	130	90	220	X
	Total				703	465	1,168	255

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AS OF JANUARY 1, 1980

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
Honeywell	DPS 8/20	4	10,500	6/80	-	-	-	100
	DPS 8/44	4	16,400	6/80	-	-	-	100
	DPS 8/52	5	42,500	6/80	-	-	-	70
	DPS 8/70	6	86,000	6/80	-	-	-	50
	Subtotal				-	-	-	320
	H-61/40	2	2,300	6/76	-	700	700	) 200
	H-61/58	2	2,500	6/74	105	480	585	)
	H-61/60	2	3,600	6/74	60	1,070	1,130	)
	H-Level 62	3	5,500	10/74	900	1,130	2,030	400
	H-64/300	4	8,300	4/79	15	-	15	) 50
	H-Level 64	4	12,000	10/74	370	720	1,090	)
	H-66/05/07	4	20,000	10/76	105	125	230	15
	H-66/10/17	5	31,500	6/75	80	96	176	5
	H-66/20/27	5	43,500	11/74	100	130	230	5
	H-66/40/60	6	84,000	10/74	97	100	197	5
	H-66/440/520	5	19,000	12/79	2	-	2	2
	H-66/DPS/BC	5	43,000	6/79	5	2	7	15
	H-66/DPS	6	79,000	7/78	55	75	130	50
	H-66/80	7	130,000	10/74	23	16	39	5
	H-68/80	7	112,000	10/74	20	3	23	X
	H-68/DPS	7	124,000	9/78	5	25	30	20
	Comshare/Xerox S-60	5	14,300	6/79	5	-	5	10
	Subtotal				1,947	4,672	6,619	782
	G-50	2	1,900	8/70	135	1,070	1,205	X
	G-100	3	4,900	4/66	65	850	915	X
	G-200	4	9,700	4/61	90	18	108	X
	G-400	4	15,900	5/64	165	125	290	X
	G-600	6	77,000	4/65	27	16	43	X
	G-6023/25	5	34,000	11/73	22	19	41	X
	G-6030/40	5	43,000	6/71	44	97	141	X
	G-6050/60	6	74,000	7/71	89	55	144	X
	G-6070/80	6	111,000	7/71	46	32	78	X
	G-6180	7	108,000	2/74	5	-	5	X
	Gamma-10	2	2,500	7/64	-	370	370	X
	Gamma-30	4	10,000	2/62	-	35	35	X
	G-Subtotal				688	2,687	3,375	-
	H-105/115	3	6,400	3/70	160	195	355	X
	H-110/120/200	3	6,600	1/66	250	190	440	X
	H-125	4	8,500	12/67	12	85	97	X
	H-2020/30	3	4,400	1/73	400	130	530	X
	H-1015/2015	4	18,700	2/71	42	37	79	X
	H-1200	4	14,600	2/66	160	53	213	X
	H-2040	4	13,800	4/72	180	93	273	X
	H-2050/2060	4	21,500	4/72	125	110	235	X
	H-2200	4	20,000	1/66	68	24	92	X
	H-2070	5	37,000	5/72	26	2	28	X
	H-3200	5	28,500	2/70	65	36	101	X
	H-4200	5	44,500	9/68	6	3	9	X
	H-8200	6	69,000	2/69	14	9	23	X
	H-4/1400	4	13,000	12/61	8	9	17	X
	H-8/1800	5	35,000	12/60	6	6	12	X
	H-Subtotal				1,522	982	2,504	-
	Total				4,157	8,341	12,498	1,102
IBM	System/38-3	2	3,600	7/80	-	-	-	6,000
	System/38-5	3	9,700	7/80	-	-	-	3,500
	System/38 Subtotal				-	-	-	9,500
	System/3-4	2	1,500	6/76	340	125	465	X
	System/3-6	2	2,000	12/70	600	450	1,050	X
	System/3-8	2	2,400	6/75	3,200	2,930	6,130	X
	System/3-10	2	3,100	1/70	5,500	3,600	9,100	X
	System/3-12	3	4,400	3/76	3,600	2,800	6,400	X
	System/3-15	3	7,900	3/74	3,450	2,120	5,570	250
	System/3 Subtotal				16,690	12,025	28,715	250
	4331	3	8,000	4/79	350	400	750	4,000
	4341	4	19,400	10/79	75	30	105	2,500
	4300 Subtotal				425	430	855	6,500
	3031	6	66,000	3/78	700	880	1,580	750
	3032	6	124,000	3/78	260	440	700	50
	3033	7	201,000	3/78	600	430	1,030	1,050
	370/115	3	10,500	4/74	860	2,020	2,880	X
	370/125	4	14,500	6/73	800	1,520	2,320	X
	370/135	4	23,000	5/72	930	1,400	2,330	X
	370/138	4	23,500	11/76	1,930	2,740	4,670	X
	370/145	5	42,500	7/71	920	1,120	2,040	X
	370/148	5	38,500	3/77	1,540	1,850	3,390	X
	370/155	6	77,000	2/71	365	220	585	X
	370/158	6	118,000	5/73	1,550	1,340	2,890	X
	370/165	7	145,000	6/71	95	32	127	X
	370/168	7	213,000	7/73	610	310	920	X
	370/195	7	296,000	3/71	10	4	14	X
	370 Subtotal				11,170	14,306	25,476	1,850
	360/20	3	2,900	12/65	670	850	1,520	X
	360/22	3	3,700	7/71	50	70	120	X
	360/25	3	8,300	10/68	55	260	315	X
	360/30	4	11,200	6/65	1,220	550	1,770	X
	360/44	4	18,700	7/66	40	29	69	X
	360/40	4	19,000	6/65	890	560	1,450	X
	360/50	5	33,000	8/65	405	210	615	X
	360/65	6	69,000	11/65	360	120	480	X
	360/67	7	140,000	6/66	11	6	17	X
	370/75	7	121,000	1/66	21	8	29	X
	360/85	7	183,000	10/69	1	-	1	X
	360/9X	7	197,000	11/67	9	5	14	X
	360 Subtotal				3,732	2,668	6,400	-
	1130	2	2,600	2/66	1,000	900	1,900	X
	1401	3	3,700	9/60	430	300	730	X
	1401-G	2	2,400	5/64	7	5	12	X
	1401-H	2	1,750	6/67	3	-	3	X
	1410	4	16,700	11/61	12	10	22	X
	1440	3	4,700	4/63	43	55	98	X
	1460	4	9,600	10/63	11	5	16	X
	1620	3	2,700	9/60	65	60	125	X
	7010	5	25,000	10/63	6	3	9	X
	7030	7	160,000	5/61	1	-	1	X
	7040/44	5	30,000	6/63	6	6	12	X
	7070/74	5	27,000	3/60	50	6	56	X
	7080	6	58,000	8/61	15	-	15	X
	7090/94	6	70,000	8/60	12	8	20	X
	Subtotal				1,661	1,358	3,019	-
	Total				33,678	30,787	64,465	18,100

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AS OF JANUARY 1, 1980

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
Magnuson	M80/3	4	6,000	1/79	10	1	11	5
	M80/4	5	8,300	12/78	45	5	50	20
	M80/32	4	6,900	5/80	-	-	-	60
	M80/42	4	10,600	9/80	-	-	-	10
	M80/43	5	12,300	9/80	-	-	-	5
	Total				55	6	61	100
National Advanced Systems	AS/3	4	16,600	11/78	30	32	62	3
	AS/4	5	25,000	6/77	30	16	46	X
	AS/5	6	40,000	3/77	130	72	202	10
	AS/7020/30	5	21,500	1/79	-	11	11	X
	AS/7031	6	35,500	12/78	35	27	62	5
	AS/6	6	63,000	5/78	40	34	74	2
	AS/3000	5	12,700	1/80	-	-	-	90
	AS/5000	6	20,000	2/80	-	-	-	50
	AS/7000	6	44,500	4/80	-	-	-	40
	Total				265	192	457	200
NCR	8270	2	2,000	11/79	100	25	125	350
	8350	2	3,400	7/77	150	15	165	50
	8370	3	6,300	7/78	15	-	15	10
	8410	2	3,300	2/79	150	-	150	175
	8430	3	5,500	6/78	44	60	104	75
	8450	3	7,900	11/77	340	170	510	200
	8455	3	6,900	4/79	60	-	60	125
	8550	3	13,300	4/76	340	270	610	X
	8555	3	10,700	4/79	50	-	50	150
	8560	4	15,700	11/77	70	25	95	X
	8565	4	14,300	4/79	15	-	15	75
	8570	4	20,000	5/76	110	105	215	X
	8575	4	18,600	4/79	15	-	15	80
	8580	5	38,000	12/78	5	10	15	X
	8585	5	37,000	8/79	10	-	10	35
	Subtotal				1,474	680	2,154	1,325
	Century 50	2	1,700	2/71	300	46	346	X
	Century 75	2	2,300	7/76	75	-	75	X
	Century 100	3	3,300	9/68	245	520	765	X
	Century 101	3	4,200	10/72	670	620	1,290	X
	Century 151	3	5,600	2/75	250	130	380	X
	Century 200	4	7,600	9/69	150	280	430	X
	Century 201	4	12,000	8/74	180	135	315	X
	Century 251	4	21,000	11/73	44	62	106	X
	Century 300	5	27,500	2/72	85	83	168	X
	315	3	3,400	5/62	36	80	116	X
	315-RMC	4	10,400	9/65	8	12	20	X
	Subtotal				2,043	1,968	4,011	-
	Total				3,517	2,648	6,165	1,325
Singer	System 10	2	2,700	10/70	1,250	-	1,250	X
Sperry Univac	III	4	27,000	8/62	75	23	98	X
	SS 80/90	3	8,500	8/58	-	2	2	X
	418 I, II	4	10,700	6/63	30	49	79	X
	418 III	4	40,500	6/69	35	83	118	X
	491/492	5	28,000	12/61	9	8	17	X
	494	6	76,000	2/66	55	58	113	X
	1004	2	1,100	2/63	200	130	330	X
	1005	2	2,000	4/66	155	60	215	X
	1050	3	9,000	9/63	115	25	140	X
	1106	6	45,500	12/69	55	170	225	X
	1107	6	60,000	10/62	4	8	12	X
	1108	7	92,000	9/65	140	80	220	X
	1110	7	149,000	6/72	44	55	99	X
	9200	2	2,300	6/67	380	400	780	X
	9300	3	5,000	9/67	340	310	650	X
	9400/80	4	12,600	5/69	165	310	475	X
	90/25	3	4,500	8/77	130	100	230	60
	90/30	3	9,300	2/75	860	1,200	2,060	175
	90/40	4	16,300	6/78	75	105	180	150
	90/60	4	27,000	1/74	125	150	275	40
	90/70/9700	5	32,000	8/72	16	42	58	5
	90/80	5	73,000	12/76	70	20	90	50
	1100/10	5	46,500	4/76	95	165	260	10
	1100/20	5	63,000	4/75	20	40	60	X
	1100/40	6	106,000	7/75	40	45	85	X
	1100/60		48,500	1/80	-	-	-	125
	1100/81/82	6	128,000	3/77	85	100	185	75
	1100/83	7	205,000	7/78	1	1	2	5
	1100/84	7	250,000	11/78	1	1	2	2
	Subtotal				3,320	3,740	7,060	697
	301	4	6,700	10/60	20	2	22	X
	501	5	15,800	6/59	1	-	1	X
	3301	5	23,500	6/64	35	-	35	X
	Spectra 70/15	3	4,600	9/65	3	-	3	X
	Spectra 70/25	3	7,800	9/65	-	7	7	X
	Spectra 70/35	4	14,400	1/67	40	2	42	X
	Spectra 70/45	5	27,000	11/65	100	2	102	X
	Spectra 70/46	5	44,500	11/68	19	-	19	X
	Spectra 70/55	5	41,500	11/68	2	-	2	X
	Spectra 70/60	6	51,000	9/70	17	-	17	X
	Spectra 70/61	6	56,000	3/71	4	-	4	X
	Spectra 1600	3	4,300	1/69	25	-	25	X
	Spectra 70/2	4	14,100	7/71	18	-	18	X
	Spectra 70/3	4	23,500	10/71	9	-	9	X
	Spectra 70/6	6	38,000	10/71	25	-	25	X
	Spectra 70/7	6	48,500	10/71	16	-	16	X
	Subtotal				334	13	347	-
	Total				3,654	3,753	7,407	697
Xerox	Sigma 5	4	14,600	8/67	115	20	135	X
	Sigma 6	4	25,500	11/70	32	13	45	X
	Sigma 7	5	29,000	12/66	57	8	65	X
	Sigma 8	4	23,000	9/71	3	4	7	X
	Sigma 9	6	59,000	11/71	65	31	96	X
	530	3	4,300	8/73	101	28	129	X
	550/560	4	15,400	11/74	28	5	33	X
	940	5	26,000	4/66	34	3	37	X
	9300	3	8,500	11/64	15	4	19	X
	Total				450	116	566	-
TOTAL					53,243	49,764	103,007	23,769

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• H PREDICTORS WHISTLING TUNES. Advanced Computer Techniques Corp. is now calling for a bridge system, the 3034, this year, with H probably first quarter 1981, as was International Data Corp. (EDP/IR,March12). ACT cites technical, logistic and business planning considerations for the probable delay of H. IDC has clarified its position, saying that IBM wants to announce a large machine in the second or third quarter. This will be either the first in the H series, the H-4, or its contingency plan machine, the 3034. In addition to needing activity at the large system level, IBM also wants to announce its Coronado disk, which should serve to stem the tide of independent 3350 shipments. The H-4 or 3034 will have about twice the power of a 3033, be multiprocessor oriented with a new version of MVS and larger address capacity, IDC thinks. Current rumors indicate IBM has achieved some production breakthroughs with its logic chips and may be able to go straight to H. Whether the insides of the system are actually H technology or 303X, it will have about the same specs and initially run the same software. The announcement date may depend on how the Armonk wizards read the current economy and user reactions to what soon will be an official recession.

• EMBARRASSING TIME BOMB -- or -- oops. Apparently there was a bad constant in the supervisor of 4300s that went haywire April 11 about 7:30 a.m., affecting ICCF and CICS -- programs with need of the real time clock. The symptoms were deceptive, but finally narrowed down by users to software, who then called IBM for a temporary fix. Parts of ICCF wouldn't work until fixed.

• SHELL JOINS EXXON IN THE OFFICE AUTOMATION arena. Shell has caught the bug via Shell Canada Limited's affiliate Alphatext Ltd., which is the major stockholder of Artel Corp. in Palo Alto. Artel has announced the Series 1000 Office Workstation that can be self-sufficient although it's designed to be part of a cluster or network of office automation products. It is based on a 16-bit microprocessor and is designed around Intel's multibus. Series 1000 combines word processing, data processing and data communication capabilities. Artel plans other products -- central mass storage, communication control and central system control for large distributed processing networks.

• HO HUM. AS EXPECTED, OPEL will take the IBM CEO slot effective Jan. 1, 1981. John Opel has been IBM president since 1974; he will add the CEO title when Chairman Frank T. Cary relinquishes that post but continues as chairman.

• ANOTHER PLUG COMPATIBLE? Yes, not one but two. Formation Inc., a company that makes applications-oriented systems, has announced its Formation 4000, which is said to have the performance of a 370/138 at less than one third the cost. Prices start at under $52K and range to $150K. The system's 32-bit architecture uses a high speed bus. And Nanodata has announced its new version in the form of the QMX 6300 Series, intended to compete with the 4300. The three models range from 130% of the power of a 370/148 to 1.1 times the 4341. It withdrew its VMX 200 and 400 after the 4300s were announced.

• PERHAPS THE WORLD ORWELL CREATED for us in 1984 is arriving a little sooner than predicted. Pacific Gas and Electric Co. has ordered from Scientific-Atlanta 8,000 "energy peak load management" control devices to be installed in homes on a trial basis. Via the units, PG&E can provide remote control cycling of high-energy consuming devices, reducing costly peak load requirements. Has big brother found his first in-road?

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REVIEW & FORECAST

EDP industry report

• THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"THE GRAY SHEET" MAY 28, 1980 • VOL.15,NO.23,24 P.J. McGOVERN,PUBLISHER

More Impervious to Recession Than in 1974

SHIPMENTS TO SUSTAIN 10%+ GROWTH DESPITE ECONOMY; EASE OF USE AND SOFTWARE REPLACE PURE SPEED AS KEY CRITERIA

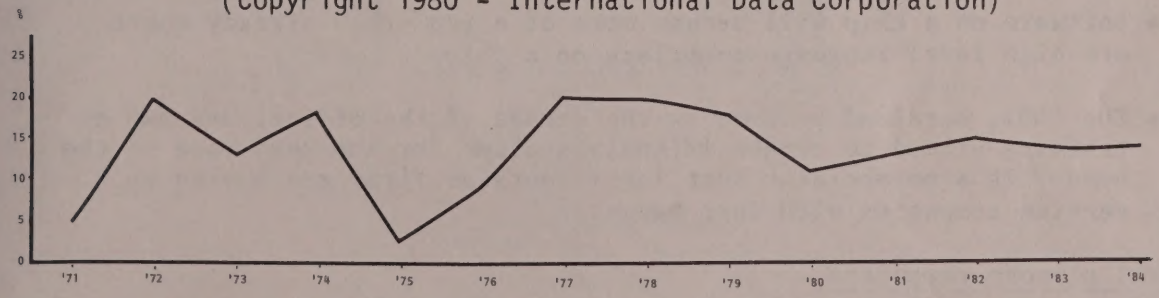
Thanks in part to a growing diversity, computer shipments will set the pace for relatively smooth computer industry sailing through the recession that appears to have received official recognition from the Rose Garden. International Data Corp., publisher of EDP/IR, sees computer system shipment dollar value growth dipping from the 20% plateau of the last few years to the 11% level in 1980 and then climbing to a steady 13% or 14% rate for mid-decade.

Whereas the value of general purpose computer shipments accounted for 90% of industry shipments in 1974, that figure will be less than half by 1984. The booming areas of small business and desktop, along with minis, will bolster the overall shipment growth rate. Thus the recession roller coaster ride gets smoother as the industry gets larger and more diverse.

To some, 1979 represents a logical evolution in the annals of the computer industry. To others it marks a watershed year when the name of the game, hardware, was replaced by software.

Software unbundling is being propagated by vendors for economic reasons, but the fact remains that what makes the difference to many users is the soft-

WORLDWIDE COMPUTER SHIPMENT GROWTH RATES
(Copyright 1980 - International Data Corporation)



The value of shipments will grow from $12 billion in 1974 to $42 billion in 1984. Shipments here include general purpose, minis, small business and desktops. The growth rates are taken from the summary table on page 12.

EDP Industry Report is published in annual volumes of twenty-four issues each by International Data Corporation, Post Office Box 915, 214 Third Avenue, Waltham, MA 02254. Entire contents © 1980 by International Data Corporation. **Director,** James Peacock; **Editor,** Molly Upton; **Census Editors,** Paul Arabasz, Lloyd Cohen; **Contributing Editors,** Dave Dillman, John Gantz, Peggy Eisen, Nancy Scull, Carol Weiszmann; **Circulation Manager,** Mary M. Trayte. Patrick J. McGovern, Chairman, International Data Group, John P. Breyer, President, International Data Corporation. Editorial ideas and information are researched and formulated by the editorial staff. Information and opinions in each issue are based on the best information available, but their accuracy and completeness cannot be guaranteed. **Subscriptions:** One year, $195; three years, $475. Single copies priced as indicated on inside pages. Prices for multiple copies on request. Reproduction without written permission is completely forbidden. Telex 92-3401; Telephone **617/890-3700.**

ware and how easy the system is to use. Presented with the dilemma of higher service costs and lower hardware prices, the vendors turned to software, the growth area of the 80s, to rescue their bottom lines. The economic effects of the unbundling move are too soon to view; all mainframers except NCR showed a smaller percentage revenue growth this year than last.

During 1979, several trends became apparent as the industry put another year under its belt.

- Improved price/performance was the byword, as vendors of not only micros and minis but mainframes tumbled over themselves to revamp their product lines, following IBM's lead with its 4300s.

- Ease of use began to replace price as the key factor in market elasticity. And the small business computer market boomed.

- Data processing is old hat; information processing is de rigeur. Hence the rage for word processing capabilities and, along with that, electronic mail and document distribution.

- Improving bottom lines became trickier. Not only was there a glitch in the heretofore smooth decline in component prices, but the personnel intensive arenas of sales and support became a larger part of the pie. Also, users hesitated ordering, hoping that IBM's forthcoming H would offer better price/performance than the 303X.

- The channel of distribution is one of the key challenges facing vendors in the '80s -- witness retail stores and orders by phone.

- The passion for networking, both local and remote, is rapidly mounting. But here again, the determining factor of its success will also be software, as in data base management and compatibility of operating systems. Local loops are getting hot. Xerox, DEC and Intel are collaborating to propose a standard based on Xerox's Ethernet that could link unlike systems. Zilog announced Z Net at NCC and IBM has its own. With the local networking fad comes a trend that involves per-person CPUs with shared resources.

- Software on a chip will become more of a reality. Already there are high level language compilers on a chip.

- The '80s, heralded by some as the decade of the office, are but a training ground to create friendly systems for the real race -- the home. It's no accident that large, outside firms are buying up service companies with data bases.

General purpose computers

The general purpose market shows many signs of maturing. For instance, hardware no longer is seen as the primary source of future revenue -- witness the general trend toward unbundling of system software and also the various pricing schemes for maintenance.

Fueled by the 303X series, the value of 1979 general purpose shipments by U.S. manufacturers rose 11% to $15.8 billion, although GP shipments were

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WORLDWIDE INSTALLED BASE 1979-1984
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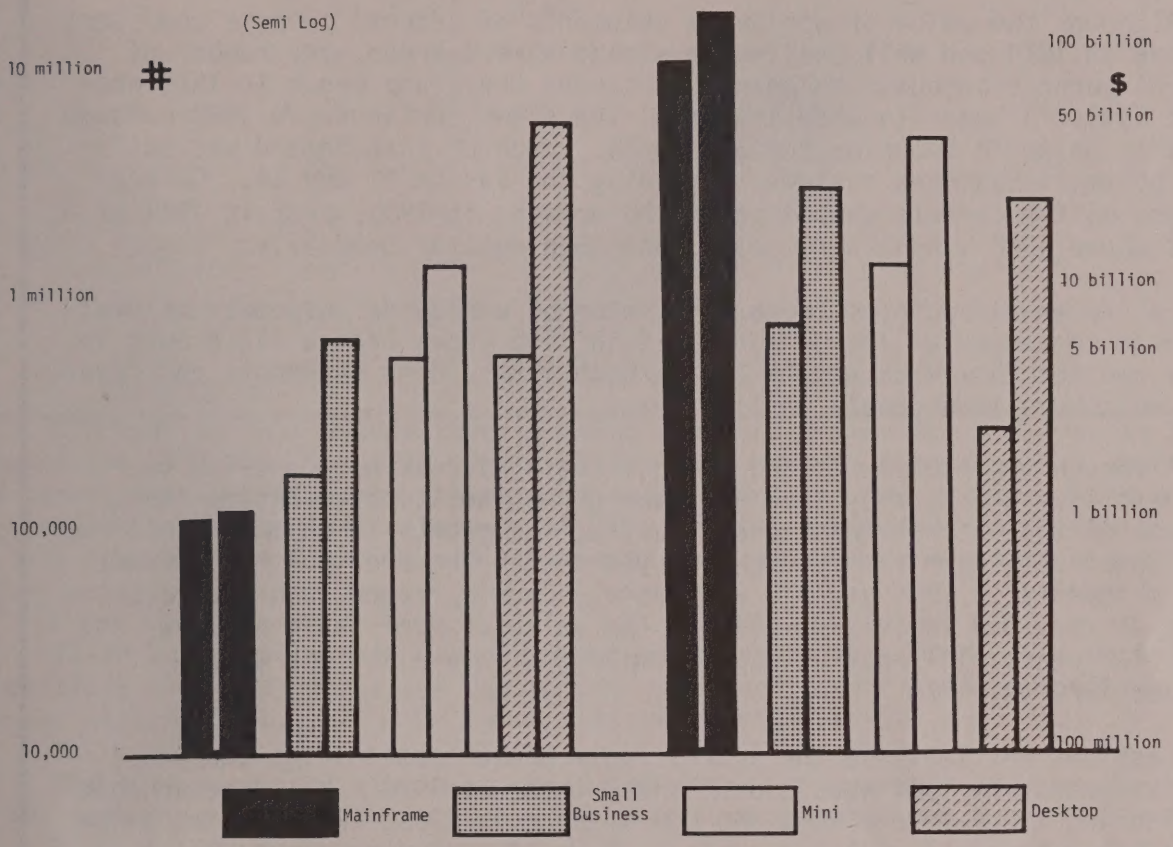

WORLDWIDE REVENUES TO U.S. MANUFACTURERS
BY INDUSTRY SECTOR
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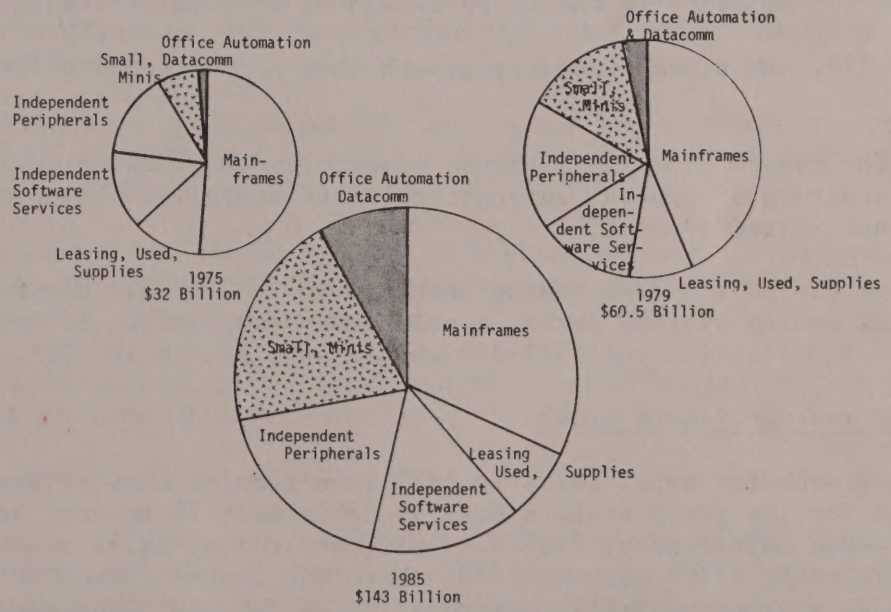

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In a Nutshell

Although the value of worldwide shipments of general purpose computers climbed in 1979 and will continue a steady upward trend, the number of general purpose computer shipments continued the slump begun in 1978 when IBM's System/3 began to show its age. The slump continued in 1979 because of IBM's delay in shipping the System/38. Much of that demand was satisfied by small business systems, including the System/32 and 34. General purpose unit shipments should be on the upswing in 1980, peak in 1981 at a point above 1977's high water mark, and then decline gradually.

In the small business arena, the value of worldwide shipments of small business computers will grow about 15% in 1980 (down from a 45% growth in 1979) and then hover at nearly 20% through 1984. Unit shipments and revenues will more than double in five years.

Although mini shipments and their value will continue to climb over the next five years, they show a slower growth anticipated during 1980. Because of the maturation of the industry, the growth in shipments will be at a lower rate over the future five years than the previous half decade. Unit shipments in 1984 vs 1979 will merely double rather than grow 2.5 times as they did in 1979 vs. 1974. The value of mini shipments over the next five years will nearly triple compared with a 3.5 times growth between 1979 vs. 1974.

Last but not least is the increasingly ubiquitous desktop computer; unit shipments by 1984 should be 5 times those of 1979. Not unremarkable considering there were almost 300,000 shipped in 1979. By 1983 the value of desktop shipments will exceed that of small business computers.

somewhat lower than IDC had anticipated. Shipments of medium size systems were not very strong because of the pause caused by the introduction of the 4300 series, but activity in this area should be especially strong in 1980.

During 1979, IBM slowed industry growth when it postponed delivery of the System/38.

Reflecting growth in large systems, especially the 303X series, the number of U.S. manufacturers' general purpose computers installed worldwide dropped as users consolidated systems.

Shipments of IBM's 4331-2 coming onstream in 1981 should create some growth in the medium systems arena, mostly from upward migration. Likewise, the expected IBM 4351 (dubbed 4341-2?) should spur growth in 1981.

Mainframers' revenue growth slows

Revenue growth for mainframers in 1979 wasn't quite what it was in 1978, with results for the group dragged down by IBM's mere 7% revenue growth. As a group, the seven mainframers, including DEC, managed an 11.3% growth in 1979 compared with their 17.6% gain in 1978, which was indeed a stellar year. The mainframers as a group generally posted gains of 12%-to-13% between the years 1975 and 1977.

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INFORMATION PROCESSING REVENUES -- LEADING MANUFACTURERS
(Million Dollars)

	1974	1975	1976	1977	1978	Δ 78-79	1979
IBM	10,510	11,850	13,400	14,765	17,074	7	18,338
NCR	1,122	1,415	1,674	1,944	2,240	17.5	2,634
Burroughs	1,293	1,457	1,612	1,794	2,083	14	2,376
Univac	1,294	1,433	1,467	1,726	2,050	13	2,316
CDC	1,101	1,246	1,358	1,513	1,868	21.7	2,273
DEC (6/30)	422	534	736	1,059	1,437	25.5	1,804
HIS*	856	856	914	1,037	1,294	12.3	1,453
TOTAL	16,598	18,791	21,161	23,838	28,046	11.2	31,194

*Excludes Cii-Bull

NCR was the only manufacturer posting a higher percentage increase in revenues for 1979 than for 1978 -- all the others' results were somewhat abated. However, despite this fact, there were still some very hefty gains in terms of revenues. DEC rose 25%, followed by CDC with 21%, and NCR weighed in with 17.5%. Both HIS and IBM showed revenue percentage gains about half of what they were in 1978.

While the seven makers' combined revenues topped the $30 billion mark for the first time, IBM's portion of the pie continued to decline to 58.8% compared with 64.3% back in 1973, when antitrust suits were being filed.

The slower pace of growth in the mainframers' revenues as well as the fact that user budgets grew faster than did mainframers' revenues point to trends:

- Mainframes account for less of the total spending picture than they have previously.

- Mainframers were caught in the frenetic race to improve price/performance. (And there were some hiccups in the smoothly declining prices of components such as memories and logic chips caused by supply and demand.)

- The reactive stance of unbundling more operating software as well as applications software is too new to reflect significant results for vendors of their size.

- Mainframers are not immune to the inflationary costs of personnel -- machines in 1979 still required people to build, sell and fix them. However, times are changing.

How significant a role each factor played in creating the softer picture for 1979 growth is hard to determine.

Mainframers in review

• Burroughs -- 1979 was notable for the introduction of the B900 family; the company enters 1980 with a record backlog of orders for these systems. Burroughs opened up the door to communication with other vendors' equipment with its CP 9400 and 9500 communications processors. The Motown maker kept

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up its courtship with banks via its BMT Series of modular terminals whose components can be intermixed, and remote teller machines.

Although Burroughs continues to acquire the pieces required to implement an integrated approach to the office automation phenomenon, it has lacked new products. In 1979 it acquired Context Corp., thus adding OCR capability.

Burroughs' revenue from software and services rose 45% during 1979, and the company expects continued expansion. Revenues from the large and medium systems portion of business grew 15.1% to $1.17 billion while small systems and office automation products grew 12.9% to $545.1 million.

• Control Data Corp. managed an astounding 71.4% growth in its computer business earnings on a 21.7% rise in revenues for that portion of its business. Overall, its computer businesses accounted for 57% of its 1979 earnings. Backlogs also set records.

CDC's peripheral business has been growing, and appears to be the star in 1979. Revenues from sales to OEMs grew 41% during the year. CDC's five year picture of revenue contribution of its three sectors shows that services holds a steady 39%-to-40% share, while peripheral products grew from 26% in 1975 to 40% in 1979 and systems dropped from 35% to 21%.

Although CDC has the former Service Bureau Company pumping away producing revenues, it has not muttered any plans to enter networking, as Tymshare has. CDC, with its Plato, has done some homework for the home market.

• Honeywell modernized its existing product line with some systems oriented toward distributed processing, the DPS 7 and 8, and brought out a new version of an operating system for its Xerox base. Shipments of its Level 6 mini were presumably strong, as the year before HIS had garnered several large contracts. In addition, Honeywell started to integrate Incoterm's product lines into its offerings, and devised a factory management system based on Level 6s and Incoterm terminals.

Honeywell Information System's operating profit rose 43% during 1979 to $152 million. HIS likes to include revenue contributions from its 47% share of Cii Honeywell Bull. The combined revenues in 1979 totaled $2.5 billion.

• IBM was almost more interesting for what it didn't do than what it did do. It didn't ship its System/38; it apparently didn't make enough 16K RAMs as it contracted for huge quantities from semiconductor houses and Japan Inc., thus drying up the supply. It also didn't unveil a bigger faster disk for its large systems and it didn't say anything about H.

IBM did begin shipping its 4300s, further unbundled operating software for the 4300, separated charges for software and hardware maintenance, announced a midlife kicker to the 303X series in the 3033N, and set the trend by raising prices for maintenance and many products. GSD got in some interesting jabs with its 5280, which some call the little brother to the 8100. Then GSD crossed into OPD's territory with the 5520 document distribution system. IBM also blessed color terminals and graphics, and even consented to make an Ascii terminal, which it sells via phone. Branching out still further, IBM made a deal that gets it into the videodisk arena -- a nice link for IBM's plans for the home market.

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IBM was taken off the hook temporarily in some antitrust suits, such as the one filed by Transamerica Corp., but the Big One still drones on, although IBM and the Justice Department have actually been talking about settlement.

IBM's offspring, Satellite Business Systems, got the go ahead and plans to launch into orbit October 23. In the meantime, that whole deal is looking more and more like a logical piece of the whole SNA-SDLC womb to tomb offering users have come to expect from Big Blue.

• NCR in 1979 demonstrated it wants to be considered a supplier of a full range of systems. It announced the V-8500M and MP families and the V-8455, thus jumping into the price and performance arena of IBM's 4300s. It also beat Memorex to the draw and walked away with Comten Corp., maker of communications front ends. Although Comten is continuing business as usual, NCR is already using Comten's knowhow to revamp its networking plans, probably with an eye toward IBM compatibility. During the year, NCR took the first step to become more independent of its general purpose terminal suppliers, and announced the 7900 general purpose terminal.

NCR's shipments of 8100s in the small business arena were very strong, nearly doubling its installed base.

• Sperry Univac's revenues topped the $2 billion mark; since 1969 its revenues have grown at an annual compound rate of 14%. Bookings and shipments also rose over the $2 billion mark. An immediate hit was its 1100/60, introduced last June, for which the company booked more than 160 systems prior to year end. The multi-microprocessor based 1100/60 spans the performance range from the 1100/10 to the 1100/80, superceding the 1100/10, 20 and 40.

Univac also introduced the Distributed Communications Processor/40 (DCP/40) that will link Univac and non-Univac systems and the Manman manufacturing software for its V77 minis.

Small business computers

Small business computers really had a bonanza year in 1979, with worldwide unit and dollar value of shipments by U.S. makers growing over 42% compared with 1978. The boom during 1979 far exceeded IDC's year-ago projections of 22% as the year stole pent-up demand from 1978 and some anticipated demand from 1980. IDC estimates about 2,000 installations during 1979 were defectors from the aging IBM System/3 base. When IBM starts shipping its 38 this summer, the scene may change. During 1979, IBM shipped 17,500 System/34s, which are small business computers.

Perhaps in part because of the boom in 1979, the recession, and manufacturers' struggles for production capacity, there will be a glitch in the shipment growth rate during 1980. In addition, the distribution network is still being set up in the U.S. Despite the glitch, shipments will rise 17% in units during 1980 with a 15% rise in value to nearly $3 billion.

During the next five years, the worldwide annual compound growth rate of unit shipments should settle at 18.5%. Between 1979 and 1984 the volume of shipments should more than double to 140,400 units. However, the small business market may find increased competition from the desktop vendors, which are adding large disks to their systems.

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WORLDWIDE SMALL BUSINESS COMPUTER SHIPMENTS 1979

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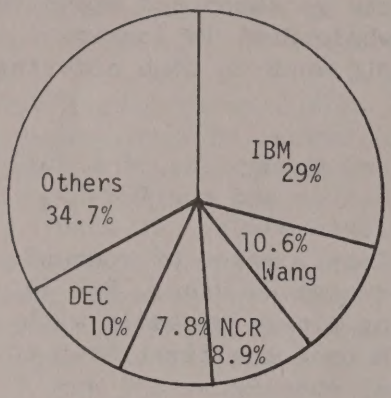
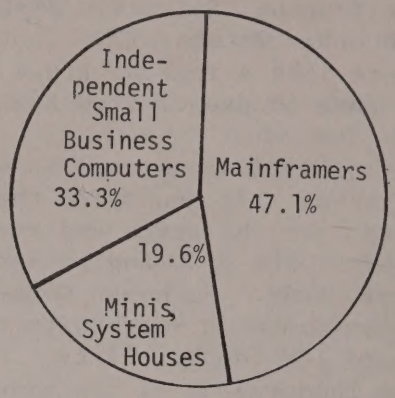


60,200 Units



60,200 Units

There are several sources of small business computers: mainframers offering products such as IBM's System/32 and 34, Burroughs' B80 and 800, NCR's 8100 and 8200; minicomputer vendors both through their own systems such as DEC's Datasystems, Data General's CS, Microdata's Reality, and through systems houses. There are also independents which make their own CPUs, such as Basic Four and Wang.

Mainframers as before grabbed the lion's share of small business shipments. NCR had the highest growth of this group; it nearly doubled its base of small business computers. The quiet Dayton manufacturer's shipments grew from 2,645 units in 1978 to 5,400 units worldwide in 1979. Most of the growth stemmed from the 8100 and 8200 series. Basic Four came next in terms of growth, posting a 49% increase in shipments, with 2,810 units shipped in 1979. IBM had a 35% growth with its System/34. Wang was quiet last year as it geared up for its recently announced 2200s, the SVP and LVP.

Minicomputers

The value of minicomputer shipments will grow 21% in 1980, in large part because the steadiness of the commercial sector's demands, primarily for superminis, should compensate for a relatively poor year of OEM business. The growth rate of shipment value, after its dip from 28% in 1979 to 21% in 1980, should rebound to the 26% area in 1981, when the OEM recovery should start early in the year. By 1982, commercial growth should be stronger than OEM.

Superminis, admittedly growing from a smaller base than the traditional mini, will continue to be the growth star in number of units shipped as well as value of shipments. During 1980, IDC sees unit shipment growth rates of microminis slowing to 17%, traditional minis falling to 6%, but superminis holding at 28% growth compared with 1979 figures.

Looking at the total mini picture, the number of minis shipped worldwide by U.S. makers should rise only 13% during 1980 compared with 18% last

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year. But by 1981, growth will pick up to 20%, aided by orders of previously postponed equipment. Over the next four years, unit shipments should grow at about the same compound rates both in the U.S. and internationally.

The mix of mini revenues is changing, as the companies find themselves in an era in which they have more responsibility to support the customer. Thus revenues from service and software are accounting for a larger share of total revenues than previously. By 1984, the mini industry should receive about 39% of its revenues from these two sectors compared with 30% in 1979.

IDC classifies minis as: micromini, which competes with the DEC LSI-11; traditional mini; and supermini, which competes with DEC's 11/44 and above.

Looking at the industry by segments, micromini unit shipments should remain at a steady 17% growth rate in 1980 and then jump to 29% in 1981. 1979's 17% growth can be explained by the precautionary attitude of the OEM market that didn't want to be caught with excess inventory. The micromini's average value will hold constant at between $2,800 and $3,000.

The traditional mini market should be looked at in terms of IBM and the rest of the world. During 1979, the growth rate of U.S. makers' unit shipments was bolstered to 16% because of IBM's Series/1 150% growth. But the industry growth rate should drop sharply to 6% for 1980, climb slightly to 9% in 1981 and then settle down to around 6% or 5%, reflecting in part the maturation of the market. Average system values should continue to grow. IBM's 1979 shipments amounted to 10.5% of the industry's 66,200 units.

IBM in the mini market has been slow to find many good OEM channels but it is proving adept at selling the unit in special applications entailing custom systems, such as supermarket energy management and distributed systems for a life insurance company. However, the Series/1 is fast aging and unless the price starts dropping could have trouble being seriously competitive. Another possibility is that IBM will update the product.

The supermini arena has been heralded as the growth area and where the bucks are. IBM has to be seriously considering entering this market. If it enters, IDC's projections may be low. But supermini unit shipments didn't grow as fast in 1979 as IDC had projected, only 28% compared with 1978's 30%.

Why didn't superminis take off as expected? Scientific markets generally grow quickly initially and many superminis were originally targeted for this market, not for the commercial sector. For instance, DEC's VAX won't have 32-bit Cobol and some easier file handling facilities until this fall. And DG's MV8000 lacks 32-bit Cobol. Also, commercial users were in a holding pattern after IBM's 4300 changed the price/performance scale.

But in 1980, these users should get off the fence. In addition, the 4300 concept will create additional demand. And there are more superminis courting the commercial market.

By 1981, unit shipments of superminis should rise 34% and thereafter decline slightly. The average system value of superminis will continue to grow from $77K in 1979 to $90K in 1984 as users want increasing capabilities. Thus the value of supermini shipments should quadruple between 1979 and 1984, from $1.3 billion to $5.3 billion.

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Desktop computers

The desktop computer segment was the fastest growing in terms of unit shipment growth during 1979. Defined by IDC by hardware parameters rather than the markets in which they might be placed, these systems are microprocessor based systems, not kits. They have at least a Basic or Basic-like language; can attach peripherals such as a disk and printer; are related to a system with an entry level price under $10,000; and are targeted for end use in scientific, business, educational, home and hobbyist environments. Some examples are: Apple, Tandy TRS 80, and Commodore at the low end and IBM 5120 and HP 9800 at the high end.

Desktop computer unit shipments of U.S.-based manufacturers should grow five-fold between 1979 and 1984, from 299,000 to 1.5 million, thus outstripping all other sectors in shipment growth. The projections assume that U.S. vendors can maintain their competitive activity in the rest of the world, despite Japanese fascination with the low end market. However, if desktops can become truly user friendly, then these projections may be quite low.

IDC projects the business/professional arena will continue to be the strongest growth area in both the U.S. and international markets. For instance, the compound growth rates in the U.S. are: business/professional, 42%; home/hobby, 25%; scientific, 30%; educational, 19%. IDC includes engineering as part of the scientific market.

Desktops are already beginning to encroach the small business computer's territory, and more battles can be expected when the desktops acquire the 8 inch mini Winchester disk, a data base management system, and Query-type language. For instance, Hewlett-Packard has put a version of its Image data base management system and a Query on its 9845. And units in the business environment are increasingly being used to handle word processing as well as DP.

The forecast assumes 1980 dollar value of systems throughout, with the prediction that vendors will provide enhancements rather than cut the costs dramatically.

Software and services

Companies in the services market spend much of their time being acquisition targets, primarily of firms outside the computer industry. With compound growth rates from 1979 through 1984 about 19% to 23% for the remote problem solving and autotransaction areas, respectively, small wonder this sector of the market looks attractive to outsiders.

Some soothsayers see few if any independent services firms left by the end of the decade. If one looks at a 1990 scenario, the new players will reflect courtship of the home market and its desire for data bases. Some examples of companies that have recently bought into the industry via the firms in parentheses: American Express (First Data Resources), McGraw-Hill (Data Resources Inc.), and Dun & Bradstreet (NCSS).

Revenues generated by the independent software market will almost triple between 1979 and 1984, with a jump from $1.67 billion to $4.54 billion. And these figures do not reflect the revenue from software pouring in to system vendors or to systems houses.

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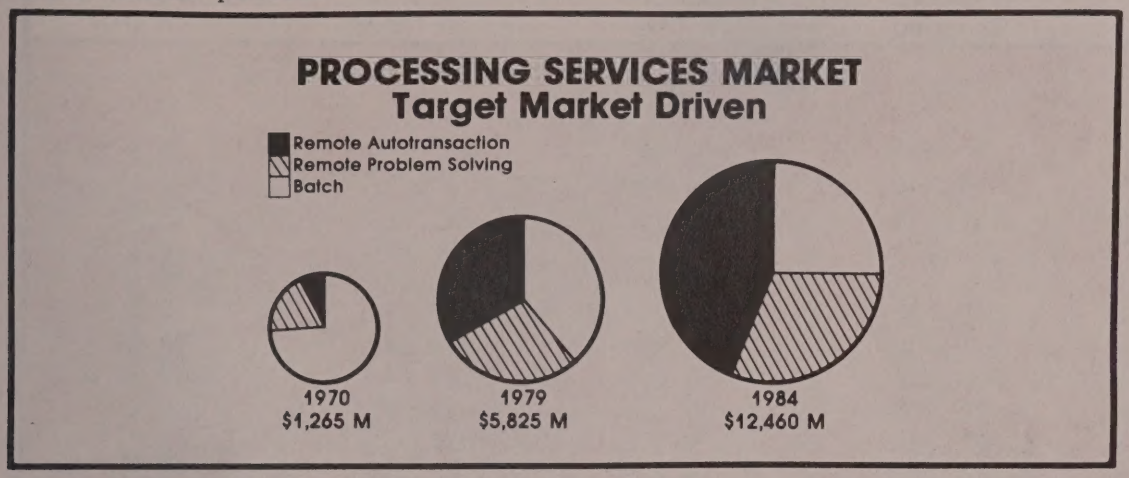
Most of the growth will come in the packaged software sector. Emerging areas are graphics, office automation and forecasting/modeling. Because IBM is unbundling, and thus raising its price floor, independents are expected to also raise their prices.



Remote autotransaction involves services of a repetitive, clerical nature such as standard accounting. In 1979, remote problem solving, which includes the traditional plain vanilla T/S as well as sophisticated applications, saw general business and administrative applications generate more revenue than scientific and engineering applications. The remote data base services sector has grown from $55 million in 1970 to $570 million in 1979 and will continue at well over 20%, reaching $1 billion to $1.5 billion by 1984. The largest target market will eventually be the consumer.

Distributed data processing

Distributed data processing (DDP) seems to have moved out of the conceptual womb into reality. Several sectors of the industry are actively marketing DDP. These include clustered processing terminals, such as Datapoint and Four-Phase; minicomputers; small business computers; and some mainframes. The U.S. installed base in 1979 hit $2 billion and should grow six-fold to $12 billion by 1983. Processors at operating nodes within DDP networks should number about 220,000 in the U.S. by the end of 1983.

Minis will lose their predominant (57%) share of the installed DDP base by 1984 when they will have 45% of the pie; clustered processing terminals will jump from 34% to 46% while small business computers remain at 9%.

• Inflation -- The value of computer system shipments shown in the Review and Forecast pages (Red) represents the price of equipment at the time of sale, i.e., the shipment values are in "current" dollars. Any "inflation" is included in the values shown. Computer system prices have, in fact, decreased over time for a given amount of computing power, and can thus be considered to have been deflationary rather than inflationary. But inflation has taken its toll by lessening the amount of price decreases. IDC expects the effects of inflation on computer prices to be only slightly higher (less than 1% annually) over the next five years than in the past five years, based on relevant economic indicators. This works out to about 7% a year for the future.

• Note -- The "Cumulative Number in Use" column accounts for retirements. The "Value in Use" column represents the if-sold value at the time of shipment.

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COMPUTER MARKET SUMMARY
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	70,350	269,690	$11,920	$ 58.5
1975	74,600	331,440	12,255	67.1
1976	104,040	412,530	13,329	76.7
1977	172,470	560,460	15,976	89.1
1978	321,910	861,320	19,152	104.6
1979	477,440	1,303,760	22,551	120.0
1980	652,400	1,916,800	24,942	138.6
1981	888,000	2,760,600	28,219	159.8
1982	1,182,800	3,895,100	32,392	184.4
1983	1,527,000	5,371,800	37,056	213.1
1984	1,903,100	7,218,400	42,118	245.9
		UNITED STATES		
1974	47,800	174,240	$ 7,096	$ 33.4
1975	49,800	213,640	6,678	37.9
1976	68,240	265,580	7,104	43.4
1977	118,080	364,820	8,878	50.4
1978	227,660	575,380	10,469	58.9
1979	313,960	862,440	12,243	66.7
1980	414,400	1,249,240	13,662	77.0
1981	551,000	1,769,640	15,592	88.9
1982	714,100	2,449,940	17,998	102.7
1983	896,300	3,311,240	20,581	118.8
1984	1,090,600	4,362,940	23,330	137.1
		INTERNATIONAL		
1974	22,550	95,450	$ 4,824	$ 25.1
1975	24,800	117,800	5,577	29.2
1976	35,800	146,950	6,225	33.3
1977	54,390	195,640	7,098	38.7
1978	94,250	285,940	8,683	45.7
1979	163,480	441,320	10,308	53.3
1980	238,000	667,560	11,280	61.6
1981	337,000	990,960	12,627	70.9
1982	468,700	1,445,160	14,394	81.7
1983	630,700	2,060,560	16,475	94.3
1984	812,500	2,855,460	18,788	108.8

This is the total of all general-purpose computers, minis, small business computers (SBCs), desktop computers, and "other" systems such as IBM's S/7. Minis used in SBCs are subtracted to eliminate double counting. Detailed tables follow (General-purpose, SBC, and desktop tables are mutually exclusive, but the minicomputer table includes computers subsequently shipped to users -- by the minimakers or by systems houses -- as small business computers.)

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GENERAL-PURPOSE COMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	15,500	110,300	$10,600	$ 54.1
1975	13,500	114,100	10,610	61.2
1976	14,800	111,200	10,830	68.5
1977	17,800	111,500	12,500	77.7
1978	10,500	111,900	14,200	88.7
1979	9,000	103,000	15,800	97.9
1980	15,400	102,500	16,500	108.8
1981	18,300	105,100	17,300	119.9
1982	16,200	107,000	18,300	131.5
1983	14,300	109,400	19,300	143.5
1984	13,600	112,100	20,400	156.0
		UNITED STATES		
1974	8,600	61,500	$ 6,200	$ 30.2
1975	6,700	62,100	5,610	33.8
1976	7,200	59,600	5,530	37.9
1977	8,900	58,200	6,600	42.9
1978	4,500	57,900	7,300	48.6
1979	4,900	53,200	7,900	52.6
1980	7,400	52,800	8,300	58.1
1981	9,100	53,800	8,700	63.7
1982	8,000	54,400	9,200	69.5
1983	7,000	55,400	9,700	75.5
1984	6,600	56,600	10,200	81.7
		INTERNATIONAL		
1974	6,900	48,800	$ 4,400	$ 23.9
1975	6,800	52,000	5,000	27.4
1976	7,600	51,600	5,300	30.6
1977	8,900	53,300	5,900	34.8
1978	6,000	54,000	6,900	40.1
1979	4,100	49,800	7,900	45.3
1980	8,000	49,700	8,200	50.7
1981	9,200	51,300	8,600	56.2
1982	8,200	52,600	9,100	62.0
1983	7,300	54,000	9,600	68.0
1984	7,000	55,500	10,200	74.3

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SMALL BUSINESS COMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	4,150	6,200	$ 200	$ 0.3
1975	10,600	16,800	400	0.7
1976	22,400	39,200	880	1.6
1977	33,500	72,700	1,300	2.9
1978	42,100	113,300	1,790	4.6
1979	60,200	169,100	2,610	7.0
1980	70,600	232,600	2,990	9.7
1981	85,200	308,400	3,610	13.0
1982	102,100	398,900	4,320	16.8
1983	118,600	504,900	5,140	21.4
1984	140,400	631,100	6,080	26.9
		UNITED STATES		
1974	3,000	4,500	$ 150	$ 0.2
1975	7,900	12,400	300	0.5
1976	14,800	27,200	580	1.1
1977	22,100	49,300	850	2.0
1978	26,400	74,200	1,140	3.0
1979	36,200	106,700	1,620	4.5
1980	41,800	143,500	1,840	6.1
1981	50,200	187,700	2,210	8.1
1982	59,800	240,500	2,630	10.4
1983	69,100	302,100	3,110	13.2
1984	81,100	374,900	3,650	16.5
		INTERNATIONAL		
1974	1,150	1,700	$ 50	$ 0.1
1975	2,700	4,400	100	0.2
1976	7,600	12,000	300	0.5
1977	11,400	23,400	450	0.9
1978	15,700	39,100	650	1.6
1979	24,000	62,400	990	2.5
1980	28,800	89,100	1,150	3.6
1981	35,000	120,700	1,400	4.9
1982	42,300	158,400	1,690	6.4
1983	49,500	202,800	2,030	8.2
1984	59,300	256,200	2,430	10.4

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MINICOMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	46,600	135,300	$ 930	$ 2.7
1975	48,600	181,400	1,155	3.8
1976	58,400	235,300	1,515	5.2
1977	82,000	311,200	2,055	7.0
1978	103,500	406,500	2,675	9.4
1979	122,000	517,000	3,430	12.6
1980	137,400	638,500	4,165	16.4
1981	164,600	783,800	5,265	21.2
1982	194,200	954,800	6,685	27.5
1983	226,200	1,153,600	8,260	35.1
1984	259,900	1,380,000	9,950	44.2
		UNITED STATES		
1974	33,900	96,100	$ 625	$ 1.9
1975	34,500	126,300	725	2.6
1976	42,000	162,300	970	3.4
1977	60,000	214,500	1,335	4.5
1978	72,200	276,800	1,715	6.0
1979	80,700	344,800	2,230	8.0
1980	89,300	419,600	2,655	10.3
1981	108,600	511,600	3,365	13.3
1982	129,300	621,100	4,275	17.2
1983	150,200	748,900	5,220	21.9
1984	171,500	894,000	6,250	27.5
		INTERNATIONAL		
1974	12,700	39,200	$ 305	$ .8
1975	14,100	55,100	430	1.2
1976	16,400	73,000	545	1.8
1977	22,000	96,700	720	2.5
1978	31,300	129,700	960	3.4
1979	41,300	172,200	1,200	4.6
1980	48,100	218,900	1,510	6.1
1981	56,000	272,200	1,900	7.9
1982	64,900	333,700	2,410	10.3
1983	76,000	404,700	3,040	13.2
1984	88,400	486,000.	3,700	16.7

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DESKTOP COMPUTER MARKET
(U.S.-BASED MANUFACTURERS)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1974	3,000	6,000	$ 40	0.1
1975	3,000	9,000	50	0.2
1976	12,000	21,000	150	0.3
1977	43,000	64,000	230	0.5
1978	172,000	236,000	756	1.3
1979	299,000	535,000	1,282	2.5
1980	444,000	979,000	1,929	4.5
1981	638,000	1,617,000	2,797	7.3
1982	892,000	2,509,000	3,959	11.2
1983	1,193,000	3,702,000	5,330	16.6
1984	1,519,000	5,221,000	6,815	23.4
		UNITED STATES		
1974	1,500	3,000	$ 20	$ *
1975	1,500	5,000	25	0.1
1976	7,000	12,000	80	0.2
1977	30,000	42,000	170	0.3
1978	129,000	171,000	495	0.8
1979	200,000	371,000	841	1.6
1980	285,000	656,000	1,240	2.9
1981	394,000	1,050,000	1,753	4.7
1982	530,000	1,580,000	2,400	7.0
1983	685,000	2,265,000	3,121	10.2
1984	849,000	3,114,000	3,881	14.1
		INTERNATIONAL		
1974	1,500	3,000	$ 20	$ *
1975	1,500	4,000	25	0.1
1976	5,000	9,000	70	0.1
1977	13,000	22,000	60	0.2
1978	43,000	65,000	261	0.5
1979	99,000	164,000	441	0.9
1980	159,000	323,000	686	1.6
1981	244,000	567,000	1,044	2.6
1982	362,000	929,000	1,559	4.2
1983	508,000	1,437,000	2,209	6.4
1984	670,000	2,107,000	2,934	9.3

*Less than $.05

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GENERAL-PURPOSE COMPUTER CENSUS

Counts in the General-Purpose Computer Census are based on the best information available to IDC -- but are estimates nevertheless. Computer makers, as a rule, do not directly supply this type of data. General-purpose computers -- as characterized by IBM's 370, 303X and competitors -- comprise the bulk of digital computers by value. They are primarily character or byte oriented and programmed in higher-level language.

Instead of being pegged to constantly shifting average values, size classes are based on currently marketed IBM products and other manufacturers' models that compete with them, e.g., a computer in Size Class 7 would compete with an IBM 3033 or 168. (Other classes can be checked under IBM's column.) Note that many mainframe manufacturers also offer smaller systems that are included in the Small Business Computer Census. An "X" in the last column means none on order from the original manufacturer. Monthly rental is based on system price including peripherals except for plug compatible vendors Amdahl, CDC-Omega, Magnuson and NAS, where only the CPU value is counted.

AS OF JANUARY 1, 1980

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
Amdahl	470V/5	6	$ 65,000	9/77	35	30	65	X
	470V/6	7	95,000	6/75	125	47	172	X
	470V/7	7	102,000	9/78	47	32	79	70
	470V/8	7	117,000	9/79	10	5	15	80
	Total				217	114	331	150
Burroughs	2/3/500	3	6,600	11/61	250	195	445	X
	1710	2	2,700	8/72	850	470	1320	X
	1720	3	7,200	2/73	500	280	780	X
	1815/25/30	2	3,100	5/77	240	320	560	200
	1855/60/70/85	3	6,400	5/77	770	250	1,020	250
	1905	2	2,700	12/79	10	-	10	300
	1955/85	3	5,000	12/79	10	-	10	350
	2500	4	10,400	2/67	22	40	62	X
	2700	4	11,000	8/72	280	165	445	X
	2800	4	11,100	12/76	210	125	335	) 200
	2900	4	12,100	12/79	10	-	10	)
	3500	4	19,000	5/67	210	225	435	X
	3700	4	26,000	11/72	285	260	545	X
	3800	4	17,100	4/77	160	75	235	) 130
	3900	4	18,600	12/79	2	-	2	)
	45/4700	5	33,000	10/71	305	125	430	X
	4800	5	32,500	9/76	160	75	235	100
	5500	5	35,000	3/63	22	10	32	X
	5700	5	33,000	12/70	3	5	8	X
	65/6700	6	66,000	11/69	145	110	255	X
	6800	5	46,100	6/77	140	95	235	) 100
	6900	5	57,000	6/80	-	-	-	)
	7700	7	130,000	8/73	49	24	73	X
	7800	7	124,000	11/78	4	2	6	25
	Total				4,637	2,851	7,488	1,655
Cambridge	1600	3	3,600	1/79	10	-	10	25
CDC	Omega 480-1	4	12,800	6/77	60	-	60	5
	Omega 480-2	5	13,700	8/78	50	-	50	25
	Omega 480-3	5	14,000	1/80	-	-	-	40
	Cyber 170-720	5	37,000	5/79	8	6	14	30
	Cyber 170-730	6	53,000	6/79	10	3	13	20
	Cyber 170-750	6	113,000	8/79	3	2	5	10
	Cyber 170-760	7	145,000	4/79	2	-	2	15
	Cyber 71	4	21,000	7/76	5	9	14	X
	Cyber 171	4	28,000	8/77	18	42	60	X
	Cyber 72	5	42,000	10/71	13	42	55	X
	Cyber 172	6	51,000	7/75	29	44	73	X
	Cyber 73	6	61,000	3/72	20	35	55	X
	Cyber 173	6	80,000	9/75	10	38	48	X
	Cyber 74	7	116,000	3/72	23	15	38	X
	Cyber 174	6	103,000	9/75	14	20	34	X
	Cyber 175	7	14,700	8/75	21	37	58	X
	Cyber 76	7	184,000	3/72	7	8	15	X
	Cyber 176	7	187,000	1/78	6	2	8	3
	G-20	4	19,300	4/61	1	-	1	X
	1604	6	41,000	1/60	5	-	5	X
	31/3150	4	9,700	12/64	43	18	61	X
	3170	5	22,500	12/70	15	17	32	X
	3200	4	14,700	5/64	25	16	41	X
	3300	5	34,500	9/65	77	42	119	X
	3400	5	23,500	11/64	3	1	4	X
	3500	5	31,000	1/69	29	10	39	X
	3600	6	49,000	6/63	13	10	23	X
	3800	6	60,000	12/65	12	1	13	X
	6200	6	42,500	11/70	-	3	3	X
	6400	6	63,000	5/66	39	26	65	X
	6500	6	86,000	12/67	15	12	27	X
	6600	7	116,000	8/64	38	21	59	X
	6700	7	140,000	7/70	3	-	3	X
	7600	7	191,000	1/69	20	7	27	X
	Star 100	7	280,000	12/74	4	-	4	X
	Cyber 203	7	250,000	11/80	-	-	-	2
	Total				641	487	1,128	150
Cray	1A	7	205,000	4/76	9	4	13	9
	1S	7	125,000	/81	-	-	-	1
DEC	2020	3	6,900	7/78	125	75	200	150
	2040	4	10,900	6/76	80	50	130	5
	2050	4	20,000	5/77	90	50	140	20
	2060	5	21,500	7/79	30	10	40	80
	PDP-6	4	10,000	10/64	3	-	3	X
	1040/50	4	17,300	10/67	130	85	215	X
	1060/70	5	21,500	6/72	115	105	220	X
	1080/90	6	31,000	6/75	130	90	220	X
	Total				703	465	1,168	255

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NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
Honeywell	DPS 8/20	4	10,500	6/80	-	-	-	100
	DPS 8/44	4	16,400	6/80	-	-	-	100
	DPS 8/52	5	42,500	6/80	-	-	-	70
	DPS 8/70	6	86,000	6/80	-	-	-	50
	Subtotal				-	-	-	320
	H-61/40	2	2,300	6/76	-	700	700	) 200
	H-61/58	2	2,500	6/74	105	480	585	)
	H-61/60	2	3,600	6/74	60	1,070	1,130	)
	H-Level 62	3	5,500	10/74	900	1,130	2,030	400
	H-64/300	4	8,300	4/79	15	-	15	) 50
	H-Level 64	4	12,000	10/74	370	720	1,090	)
	H-66/05/07	4	20,000	10/76	105	125	230	15
	H-66/10/17	5	31,500	6/75	80	96	176	5
	H-66/20/27	5	43,500	11/74	100	130	230	5
	H-66/40/60	6	84,000	10/74	97	100	197	5
	H-66/440/520	5	19,000	12/79	2	-	2	2
	H-66/DPS/BC	5	43,000	6/79	5	2	7	15
	H-66/DPS	6	79,000	7/78	55	75	130	50
	H-66/80	7	130,000	10/74	23	16	39	5
	H-68/80	7	112,000	10/74	20	3	23	X
	H-68/DPS	7	124,000	9/78	5	25	30	20
	Comshare/Xerox S-60	5	14,300	6/79	5	-	5	10
	Subtotal				1,947	4,672	6,619	782
	G-50	2	1,900	8/70	135	1,070	1,205	X
	G-100	3	4,900	4/66	65	850	915	X
	G-200	4	9,700	4/61	90	18	108	X
	G-400	4	15,900	5/64	165	125	290	X
	G-600	6	77,000	4/65	27	16	43	X
	G-6023/25	5	34,000	11/73	22	19	41	X
	G-6030/40	5	43,000	6/71	44	97	141	X
	G-6050/60	6	74,000	7/71	89	55	144	X
	G-6070/80	6	111,000	7/71	46	32	78	X
	G-6180	7	108,000	2/74	5	-	5	X
	Gamma-10	2	2,500	7/64	-	370	370	X
	Gamma-30	4	10,000	2/62	-	35	35	X
	G-Subtotal				688	2,687	3,375	-
	H-105/115	3	6,400	3/70	160	195	355	X
	H-110/120/200	3	6,600	1/66	250	190	440	X
	H-125	4	8,500	12/67	12	85	97	X
	H-2020/30	3	4,400	1/73	400	130	530	X
	H-1015/2015	4	18,700	2/71	42	37	79	X
	H-1200	4	14,600	2/66	160	53	213	X
	H-2040	4	13,800	4/72	180	93	273	X
	H-2050/2060	4	21,500	4/72	125	110	235	X
	H-2200	4	20,000	1/66	68	24	92	X
	H-2070	5	37,000	5/72	26	2	28	X
	H-3200	5	28,500	2/70	65	36	101	X
	H-4200	5	44,500	9/68	6	3	9	X
	H-8200	6	69,000	2/69	14	9	23	X
	H-4/1400	4	13,000	12/61	8	9	17	X
	H-8/1800	5	35,000	12/60	6	6	12	X
	H-Subtotal				1,522	982	2,504	-
	Total				4,157	8,341	12,498	1,102
IBM	System/38-3	2	3,600	7/80	-	-	-	6,000
	System/38-5	3	9,700	7/80	-	-	-	3,500
	System/38 Subtotal				-	-	-	9,500
	System/3-4	2	1,500	6/76	340	125	465	X
	System/3-6	2	2,000	12/70	600	450	1,050	X
	System/3-8	2	2,400	6/75	3,200	2,930	6,130	X
	System/3-10	2	3,100	1/70	5,500	3,600	9,100	X
	System/3-12	3	4,400	3/76	3,600	2,800	6,400	X
	System/3-15	3	7,900	3/74	3,450	2,120	5,570	250
	System/3 Subtotal				16,690	12,025	28,715	250
	4331	3	8,000	4/79	350	400	750	4,000
	4341	4	19,400	10/79	75	30	105	2,500
	4300 Subtotal				425	430	855	6,500
	3031	6	66,000	3/78	700	880	1,580	750
	3032	6	124,000	3/78	260	440	700	50
	3033	7	201,000	3/78	600	430	1,030	1,050
	370/115	3	10,500	4/74	860	2,020	2,880	X
	370/125	4	14,500	6/73	800	1,520	2,320	X
	370/135	4	23,000	5/72	930	1,400	2,330	X
	370/138	4	23,500	11/76	1,930	2,740	4,670	X
	370/145	5	42,500	7/71	920	1,120	2,040	X
	370/148	5	38,500	3/77	1,540	1,850	3,390	X
	370/155	6	77,000	2/71	365	220	585	X
	370/158	6	118,000	5/73	1,550	1,340	2,890	X
	370/165	7	145,000	6/71	95	32	127	X
	370/168	7	213,000	7/73	610	310	920	X
	370/195	7	296,000	3/71	10	4	14	X
	370 Subtotal				11,170	14,306	25,476	1,850
	360/20	3	2,900	12/65	670	850	1,520	X
	360/22	3	3,700	7/71	50	70	120	X
	360/25	3	8,300	10/68	55	260	315	X
	360/30	4	11,200	6/65	1,220	550	1,770	X
	360/44	4	18,700	7/66	40	29	69	X
	360/40	4	19,000	6/65	890	560	1,450	X
	360/50	5	33,000	8/65	405	210	615	X
	360/65	6	69,000	11/65	360	120	480	X
	360/67	7	140,000	6/66	11	6	17	X
	370/75	7	121,000	1/66	21	8	29	X
	360/85	7	183,000	10/69	1	-	1	X
	360/9X	7	197,000	11/67	9	5	14	X
	360 Subtotal				3,732	2,668	6,400	-
	1130	2	2,600	2/66	1,000	900	1,900	X
	1401	3	3,700	9/60	430	300	730	X
	1401-G	2	2,400	5/64	7	5	12	X
	1401-H	2	1,750	6/67	3	-	3	X
	1410	4	16,700	11/61	12	10	22	X
	1440	3	4,700	4/63	43	55	98	X
	1460	4	9,600	10/63	11	5	16	X
	1620	3	2,700	9/60	65	60	125	X
	7010	5	25,000	10/63	6	3	9	X
	7030	7	160,000	5/61	1	-	1	X
	7040/44	5	30,000	6/63	6	6	12	X
	7070/74	5	27,000	3/60	50	6	56	X
	7080	6	58,000	8/61	15	-	15	X
	7090/94	6	70,000	8/60	12	8	20	X
	Subtotal				1,661	1,358	3,019	-
	Total				33,678	30,787	64,465	18,100

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AS OF JANUARY 1, 1980

NAME OF MANUFACTURER	COMPUTER MODEL	SIZE CLASS	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS IN U.S.	NUMBER OF INSTALLATIONS OUTSIDE U.S.	TOTAL NUMBER OF INSTALLATIONS	TOTAL NUMBER UNFILLED ORDERS
Magnuson	M80/3	4	6,000	1/79	10	1	11	5
	M80/4	5	8,300	12/78	45	5	50	20
	M80/32	4	6,900	5/80	-	-	-	60
	M80/42	4	10,600	9/80	-	-	-	10
	M80/43	5	12,300	9/80	-	-	-	5
	Total				55	6	61	100
National Advanced Systems	AS/3	4	16,600	11/78	30	32	62	3
	AS/4	5	25,000	6/77	30	16	46	X
	AS/5	6	40,000	3/77	130	72	202	10
	AS/7020/30	5	21,500	1/79	-	11	11	X
	AS/7031	6	35,500	12/78	35	27	62	5
	AS/6	6	63,000	5/78	40	34	74	2
	AS/3000	5	12,700	1/80	-	-	-	90
	AS/5000	6	20,000	2/80	-	-	-	50
	AS/7000	6	44,500	4/80	-	-	-	40
	Total				265	192	457	200
NCR	8270	2	2,000	11/79	100	25	125	350
	8350	2	3,400	7/77	150	15	165	50
	8370	3	6,300	7/78	15	-	15	10
	8410	2	3,300	2/79	150	-	150	175
	8430	3	5,500	6/78	44	60	104	75
	8450	3	7,900	11/77	340	170	510	200
	8455	3	6,900	4/79	60	-	60	125
	8550	3	13,300	4/76	340	270	610	X
	8555	3	10,700	4/79	50	-	50	150
	8560	4	15,700	11/77	70	25	95	X
	8565	4	14,300	4/79	15	-	15	75
	8570	4	20,000	5/76	110	105	215	X
	8575	4	18,600	4/79	15	-	15	80
	8580	5	38,000	12/78	5	10	15	X
	8585	5	37,000	8/79	10	-	10	35
	Subtotal				1,474	680	2,154	1,325
	Century 50	2	1,700	2/71	300	46	346	X
	Century 75	2	2,300	7/76	75	-	75	X
	Century 100	3	3,300	9/68	245	520	765	X
	Century 101	3	4,200	10/72	670	620	1,290	X
	Century 151	3	5,600	2/75	250	130	380	X
	Century 200	4	7,600	9/69	150	280	430	X
	Century 201	4	12,000	8/74	180	135	315	X
	Century 251	4	21,000	11/73	44	62	106	X
	Century 300	5	27,500	2/72	85	83	168	X
	315	3	3,400	5/62	36	80	116	X
	315-RMC	4	10,400	9/65	8	12	20	X
	Subtotal				2,043	1,968	4,011	-
	Total				3,517	2,648	6,165	1,325
Singer	System 10	2	2,700	10/70	1,250	-	1,250	X
Sperry Univac	III	4	27,000	8/62	75	23	98	X
	SS 80/90	3	8,500	8/58	-	2	2	X
	418 I, II	4	10,700	6/63	30	49	79	X
	418 III	4	40,500	6/69	35	83	118	X
	491/492	5	28,000	12/61	9	8	17	X
	494	6	76,000	2/66	55	58	113	X
	1004	2	1,100	2/63	200	130	330	X
	1005	2	2,000	4/66	155	60	215	X
	1050	3	9,000	9/63	115	25	140	X
	1106	6	45,500	12/69	55	170	225	X
	1107	6	60,000	10/62	4	8	12	X
	1108	7	92,000	9/65	140	80	220	X
	1110	7	149,000	6/72	44	55	99	X
	9200	2	2,300	6/67	380	400	780	X
	9300	3	5,000	9/67	340	310	650	X
	9400/80	4	12,600	5/69	165	310	475	X
	90/25	3	4,500	8/77	130	100	230	60
	90/30	3	9,300	2/75	860	1,200	2,060	175
	90/40	4	16,300	6/78	75	105	180	150
	90/60	4	27,000	1/74	125	150	275	40
	90/70/9700	5	32,000	8/72	16	42	58	5
	90/80	5	73,000	12/76	70	20	90	50
	1100/10	5	46,500	4/76	95	165	260	10
	1100/20	5	63,000	4/75	20	40	60	X
	1100/40	6	106,000	7/75	40	45	85	X
	1100/60		48,500	1/80	-	-	-	125
	1100/81/82	6	128,000	3/77	85	100	185	75
	1100/83	7	205,000	7/78	1	1	2	5
	1100/84	7	250,000	11/78	1	1	2	2
	Subtotal				3,320	3,740	7,060	697
	301	4	6,700	10/60	20	2	22	X
	501	5	15,800	6/59	1	-	1	X
	3301	5	23,500	6/64	35	-	35	X
	Spectra 70/15	3	4,600	9/65	3	-	3	X
	Spectra 70/25	3	7,800	9/65	-	7	7	X
	Spectra 70/35	4	14,400	1/67	40	2	42	X
	Spectra 70/45	5	27,000	11/65	100	2	102	X
	Spectra 70/46	5	44,500	11/68	19	-	19	X
	Spectra 70/55	5	41,500	11/68	2	-	2	X
	Spectra 70/60	6	51,000	9/70	17	-	17	X
	Spectra 70/61	6	56,000	3/71	4	-	4	X
	Spectra 1600	3	4,300	1/69	25	-	25	X
	Spectra 70/2	4	14,100	7/71	18	-	18	X
	Spectra 70/3	4	23,500	10/71	9	-	9	X
	Spectra 70/6	6	38,000	10/71	25	-	25	X
	Spectra 70/7	6	48,500	10/71	16	-	16	X
	Subtotal				334	13	347	-
	Total				3,654	3,753	7,407	697
Xerox	Sigma 5	4	14,600	8/67	115	20	135	X
	Sigma 6	4	25,500	11/70	32	13	45	X
	Sigma 7	5	29,000	12/66	57	8	65	X
	Sigma 8	4	23,000	9/71	3	4	7	X
	Sigma 9	6	59,000	11/71	65	31	96	X
	530	3	4,300	8/73	101	28	129	X
	550/560	4	15,400	11/74	28	5	33	X
	940	5	26,000	4/66	34	3	37	X
	9300	3	8,500	11/64	15	4	19	X
	Total				450	116	566	-
TOTAL					53,243	49,764	103,007	23,769

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SMALL BUSINESS COMPUTER CENSUS

The categorization of certain computers as "small business computers" is based on marketplace definitions as perceived by IDC. SBCs are those small general-purpose computers marketed to smaller businesses, first-time users, and increasingly to small units of large organizations. They include offerings from the major mainframers (such as IBM's System/32 and 34); products such as DEC's Datasystem/300 from the minimakers but aimed at commercial first-time users; equipment from firms (such as Qantel) that manufacture only SBCs; and products from companies that market systems assembled from others' minicomputers (i.e., systems houses).

AS OF JANUARY 1, 1980

NAME OF MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	NOTES	PURCHASE PRICE ($1,000) BASIC	PURCHASE PRICE ($1,000) AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1980 INSTALLATION
Advanced Information Design*	System 3000	Interdata X/16		24	39	3/75	41	0	41	X
Anderson Jacobson	1400	AJ 1400	a	16	22	1/70	260	15	275	X
	1520 Series	AJ 1500		19	21	7/77	200	25	225	12
	1560 Series	AJ 1500		30	35	7/77	60	3	63	12
	Total						520	43	563	24
Applied Computer Systems	Smart Alec	8080 A		12	13	1/77	47	17	64	68
Applied Data Communications	Event	Event 2000		13	20	2/77	150	12	162	100
	Clinic 2	Event 2000		19	23	6/79	20	0	20	60
	Event 3000	8080 A		22	22	12/79	1	0	1	100
	League Master	8080 A		23	23	/80	0	0	0	50
	Total						171	12	183	310
Applied Data Processing, Inc.	Resource 50	Nova 3/4		31	52	9/79	1	0	1	3
	Resource 100	Nova 3/12		41	72	6/79	16	0	16	3
	Total						17	0	17	6
Applied Digital Data Systems, Inc.	ADDS/Vantage	8080		11	14	7/76	550	400	950	NA
Astrocom	Series 760	Z80		16	20	6/79	10	0	10	NA
Ball Computer Products*	DASL	Nova 2/10		38	40	6/75	3	0	3	X
Basic Four Corporation	200	BFC 1340		25	29	2/78	110	293	403	430
	350	BFC 1300, Microdata	b	34	34	9/71	500	576	1,076	X
	400	BFC 1300, Microdata	b	37	45	9/71	1,712	1,739	3,451	X
	410	BFC 1300		33	40	10/78	507	969	1,476	1,250
	500	BFC 1300, Microdata	b	39	50	7/72	100	82	182	X
	600	BFC 1300, Microdata	b	51	65	3/75	300	308	608	X
	610	BFC 1320		51	65	1/78	759	549	1,308	1,000
	700	BFC 1320		115	130	/77	109	99	208	X
	730	BFC 1350		95	25	6/78	319	279	598	530
	Total						4,416	4,894	9,310	3,210
Basic Time	B-100	Digidyne		16	16	7/79	25	10	35	25
	B-200	Digidyne		20	20	11/79	0	0	0	10
	Total						0	10	35	35
Binary Data Systems	Award	Eclipse S/130		150	250	/75	12	0	12	12
	BBPS	Eclipse S/130		125	150	/78	5	0	5	6
	GBS	Eclipse S/130, S/140, Nova 4		75	125	/75	40	0	40	20
	Total						57	0	57	38
BRD	Dolphin	6800		18	20	6/77	400	30	430	9
	Porpoise	6800		10	13	1/78	160	5	165	9
	Total						560	35	595	18
Briareus	Briareus	EDS Point 4		23	30	1/76	80	0	80	55
Broadcast Management Concept	Mesa Two	Nova 4	c	60	85	4/78	30	0	30	6
BTI Computer Systems	4000/15	BTI 4020		36	40	1/76	341	8	349	X
	4000/25	BTI 4020		56	65	1/76	251	12	263	X
	5000	BTI 5030		39	49	9/78	1,420	40	1,460	900
	5000/ES	BTI 5000		30	36	7/79	60	0	60	150
	Total						2,072	60	2,132	1,050
Burroughs	B 80	B 80		17	34	11/76	3,000	4,300	7,300	3,000
	B 90	B 90		18	33	12/79				
	B 700	B 700		26	68	3/33	2,400	1,800	4,200	X
	B 800	B 800		35	55	5/77	2,100	1,500	3,600	2,000
	Total						7,500	7,600	15,100	5,000
Business Controls Corporation	System 80	PDP-8/a		25	40	6/71	60	0	60	X
	Business Control System	PDP-11/23/34/ 44/70, VAX		40	80	6/75	85	10	95	40
	Total						145	10	155	40
Business Systems Products*	Adviser	C.A. Syfa		42	50	7/76	111	0	111	X
Cado	Cado System 20	Intel 8080		12	16	1/78	500	150	650	
	Cado System 40	Intel 8080		18	20	4/76	250	60	310	
	Cado System 20/4	Intel 8085		17	30	6/78	1,100	200	1,300	2,500
	Cado System 40/4	Intel 8085		20	37	6/78	50	300	350	
	Cado System 20/2	Intel 8085		15	20	7/79	50	50	100	
	Total						1,950	760	2,710	2,500
Cascade Data, Inc.	80/20,30,40	Concept		28	43	1/70	50	0	50	X
	Concept II	Concept		27	35	6/75				X
	Concept III	Concept		32	39	1/78	312	15	327	NA
	Concept IV	Concept		17	19	4/78				
	Total						362	15	377	
Century Computer Corp.	C-400	C-200,400		34	45	3/75	204	39	243	NA
	C-700	C-200,400		38	55	6/76	55	11	66	NA
	C-900	C-400		27	40	4/77	127	27	154	NA
	C-1000	C-400		40	50	6/77	22	0	22	NA
	Opus III	C-200		15	22	2/71	560	40	600	X
	Total						968	117	1,085	
Cincinnati Milacron	George 40	CIP/2200 B		16	20	2/77				NA
	George 60	CIP/2200 B		26	34	/76				NA
	George 70	CIP/2200 B		26	35	/76	670	150	820	NA
	George 80	CIP/4400		43	60	12/76				X
	Other	CIP/2200 B		23	34	/74				NA
Clary Data Systems*	404	Clary		6	30	1/70	100	32	132	X
Compal	9000	602,Nova 4C,4S,4x		26	30	1/80	0	0	0	50

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Complete Computer Systems	10,11,12	Nova 3/12		31	43	3/74	17	0	17	
	14,16,18	Nova 3/12		45	58	10/76	29	0	29	14
	20,22,24	Nova 3/12		58	74	9/77	8	0	8	
	Total						54	0	54	
Compucorp*	402	Compucorp 3000		13	15	1/76	15	455	470	X
	450	Compucorp 3000		20	22	4/76	40	115	155	X
	Total						55	570	625	
Computer Hardware, Inc.	2120	CHI		15	50	5/75	10	0	10	X
	2130 C	CHI C		32	75	7/74	350	4	354	10
	2130 D	CHI D		44	120	1/78	10	1	11	3
	3230	CHI		15	50	6/76	60	0	60	60
	4210	CHI		13	13	9/77	4	0	4	1
	4250	CHI		37	45	6/78	7	0	7	1
	Total						441	5	446	75
Computer Interactions, Inc.	Compo II-8	PDP-8/e,f,m		40	55	11/72	235	0	235	35
	Compo II-11	PDP-11		40	55	6/75	210	0	210	90
	Word Pro II	PDP-8/a, Nova, H-P		13	19	2/77	320	0	320	190
	Total						765	0	765	315
Data General	CS/20	MicroNova		11	20	7/78	100	20	120	NA
	CS/30	MicroNova		21	25	8/79	200	50	250	NA
	CS/40	Nova 3/12		33	40	10/77	1,000	250	1,250	NA
	CS/50	MicroNova 4S,4X		32	68	/80	0	0	0	NA
	CS/60	Eclipse		40	75	7/78	1,100	0	1,100	NA
	Design Data EC300	Eclipse C/300	d	60	150	3/76	50	10	60	X
	Design Data N312	Nova 3/12	d	31	75	8/75	120	10	130	X
	Synergist 1500	MicroNova	e	8	24	/76	30	0	30	35
	Synergist 1550	MicroNova	e	14	21	7/78	45	0	45	35
	Synergist 2500	Nova 3/12	e	27	40	/76	215	0	215	115
	Synergist 3700	Nova 3/D	e	40	60	/76	30	0	30	
	Total						2,890	340	3,230	
Decision Data Computer Corporation*	System/4	System/4		23	37	8/76	15	0	15	X
Diablo Systems, Inc.	3200	8080	f	19	23	1/77	1,000	1,500	2,500	NA
Digital Equipment Corporation	Datasystem 300	PDP-8, PDP-11		14	30	/72	6,300	4,000	10,300	3,000
	Datasystem 500	PDP-11		58	115	/72	1,400	1,500	2,900	1,200
	DECstation 78	PDP-8		8	11	9/78	800	500	1,300	1,000
	DECstation 88	PDP-8A		12	15	3/78				
	Total						8,500	6,000	14,500	5,200
Digital Systems Corporation	Galaxy/5	Galaxy/5		90	120	1/76	32	0	32	6
	Galaxy/3	Galaxy/3		50	65	1/80	3	0	3	4
	Total						35	0	35	10
Dimis, Inc.	Total 100	Modcomp II, Classic		110	155	1/79	27	0	27	NA
Display Data Corporation	Insight	Microdata 1600/30		38	59	1/74	800	10	810	300
	ELS System	Microdata 1600/30		27	33	5/78	250	0	250	100
	Total						1,050	10	1,060	400
DTC	TaskMaster	8080		17	19	9/78	25	90	115	100
Financial Computer Corporation*	System III/6	System III		19	25	9/77	28	0	28	X
	System III/8	System III		23	32	9/77	22	0	22	X
	System III/10	System III		30	45	1/75	440	55	495	X
	Total						490	55	545	
Gemini Information Systems	Gispac/1	Series I		54	66	4/78	17	0	17	12
	Gispac/16	Interdata X/16		54	65	4/76	39	0	39	16
	Gispac/32	Interdata X/32		97	110	4/76	22	0	22	14
	Total						78	0	78	42
General Automation, Inc.	DM-130/2	SPC-16/45		28	28	12/74	150	350	500	X
	DM-130	SPC-16/45		30	38	12/74	80	180	260	X
	DM-140	SPC-16/65		48	80	1/75	7	18	25	X
	440-DS	GA-16/440		38	70	1/76	35	65	100	X
	460-DS	GA-16/460		35	80	11/78	10	30	40	NA
	Total						282	643	925	
General Information Systems	GIS-350 ABLE	PDP-11/34		36	40	1/76	20	0	20	6
General Robotics Corporation	Gemini (FO/X3)	LSI-11		10	21	7/76	180	195	375	150
	Tristar (FO/X3)	LSI-11		11	22	7/76	60	65	125	50
	Pegasus (CO/X3)	LSI-11		18	39	9/77	100	100	200	100
	Total						340	360	700	300
GRI Computer Corporation	System 99	GRI 99/50		30	35	11/74	196	88	284	NA
	System 99/E	GRI 99/52		43	50	11/77	35	15	50	NA
	Total						231	103	334	
Hewlett-Packard	HP 250	HP 250		24	42	9/78	500	600	1,100	1,500
	HP 300	HP 300		30	55	9/78	200	300	500	500
	Total						700	900	1,600	2,000
IBM	System/32	IBM S/32	g	27	42	3/75	9,800	5,400	15,200	X
	System/34	IBM S/34		35	50	12/77	20,500	9,500	30,000	19,000
	Total						30,300	14,900	45,200	19,000
Infotecs	iMP	IM 6100		10	15	9/77	505	26	531	1,050
International Computing Corporation*	System 95/99	Nova 2/10		24	35	10/72	9	0	9	X
Jacquard	J100	NS IMP-16		22	44	8/75	800	700	1,500	NA
Keydata	Unity Series	Nova 3/4,3/12, 3/D		48	80	4/79	5	28	33	30
Lockheed Electronics Company, Inc.	System III	Lockheed SUE		30	50	1/73	465	130	595	X
Logical Machine Corporation	ADAM I	ADAM		30	35	4/75	352	404	756	291
	TINA	TINA		18	20	12/78	184	532	716	420
	ADAM II	ADAM		25	30	10/79	5	33	38	240
	Total						541	969	1,510	951
Martin Wolfe, Inc.*	Mesa Two 7000	DCC-116		54	81	12/71	140	0	140	X
	Mesa Two 4000	DCC-116		62	93	2/76	3	0	3	X
	Total						143	0	143	
Microdata	Reality	Microdata 1600		32	60	12/73	2,600	500	3,100	NA
	Reality 2000	Microdata 1600		32	36	6/79	30	0	30	NA
	Reality 4000	Microdata 1600		38	50	6/79	120	0	120	NA
	Reality 6000	Microdata 1600		62	76	6/79	300	12	312	NA
	Reality 8000	Microdata 1600		85	95	2/80	2	0	2	NA
	Total						3,052	512	3,564	
Microstar, Inc.*	Microstar I	Zilog Z80		13	17	12/78	5	0	5	X
	Microstar II	Zilog Z80		14	19	12/78				X
Mini-Computer Systems, Inc.	Micos 100	Nova 3/4		34	40	8/77	40	60	100	20
	Micos 200	Nova 3/12		40	60	/73	855	375	1,230	300
	Micos 300	Dual Nova 3/12		100	140	1/79	1	0	1	25
	Micos 75	Nova 3/4		26	26	9/79	12	10	22	60
	Total						908	445	1,353	405

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Minutemen Computer Corporation	1774	Nova 3/4		30	40	11/71	56	0	56	
	1775	Nova 3/12		32	44	3/72	33	0	33	
	1776	Nova 3/12		35	59	3/72	31	0	31	40
	1776/A	Nova 3/12		35	65	5/77	30	0	30	
	Total						150	0	150	40
Moore Business Systems	MBS 20/50	DS 990/1		20	25	1/80	0	0	0	250
Mylee Digital Sciences, Inc.	3000 Series	Mylee 3G		29	60	5/76	150	0	150	5
NCR Corporation	8130	NCR		19	23	3/78	1,000	1,400	2,400	1,800
	8150	NCR		27	34	12/77				
	8200	NCR		33	63	9/75				
	8230	NCR		31	45	6/77	5,200	4,200	9,400	4,000
	8250	NCR		34	64	12/76				
	Total						6,200	5,600	11,800	5,800
Norfield Datasystems, Inc.*	Nova-System	Nova		35	50	6/73	20	0	20	X
Northrop Data Systems	BDS 500	Microdata 1600		30	48	3/77	40	0	40	
	BDS 1000	Microdata 1600		35	55	6/72	75	0	75	211
	BDS 2000	Microdata 1600		43	73	10/73	88	0	88	
	BDS 4000	Microdata 1600		51	85	10/79	8	0	8	
	Total						211	0	211	211
Pick & Associates	Unit 1	Multi 6		65	77	11/73	156	18	174	60
	Unit 2	Multi 6		88	97	10/77	25	4	29	23
	Total						181	22	203	83
Prodigy Systems, Inc.	Prodigy 1	Z80-A		13	14	5/79	40	20	60	400
	Prodigy 2	Z80-A		14	16	6/80	0	0	0	100
	Total						40	20	60	500
Programmed Control Corporation	Prophet 21/1	TI 960-B		42	75	/72	40	0	40	3
	Prophet 21/2	TI 990/10		57	100	1/78	30	1	31	15
	Total						70	1	71	18
Q1 Corporation	Q1/LMC	8080		21	23	2/74	550	0	550	8
	Q1/LITE	8800		21	26	2/77	460	350	810	300
	Q1/MICROLITE	8800		8	14	1/79	120	100	220	100
	Total						1,130	450	1,580	408
Qantel	210	Q29		12	17	11/77	200	500	700	300
	800/900	Q7		28	29	5/75	85	62	147	X
	950	Q7		28	33	11/75	600	240	840	150
	960	Q7.5		30	35	11/76	220	70	290	150
	970	Q29B		36	40	1/79	50	180	230	150
	1200	Q7		42	59	11/75	200	20	220	X
	1300	Q7.5		42	59	11/75	40	15	55	X
	1400,-2	Q7.5		44	70	5/77	360	170	530	0
	1450,-2	Q29B		45	80	1/79	80	40	120	100
	Total						1,835	1,297	3,132	850
Quodata Corporation (Educomp)	E-250,500	PDP-8		15	30	/72				
	E-660,760, 820,960	PDP-11		44	100	/75	250	40	290	11
	QDP/78	PDP-8		10	10	/77				
	ECS/7800	PDP-8		10	11	/77				
Randal Data Systems*	R-100 Series	Randal		14	17	10/75	257	13	270	X
	R-200 Series	Randal		24	30	10/76	382	0	382	X
	R-300 Series	Nova 2/10		34	45	6/74	27	0	27	X
	R-400 Series	Nova 2/10		36	45	6/74				X
	R-500 Series	Randal		42	47	10/77	45	0	45	X
	Total						711	13	724	
Retail Sciences, Inc.	Clerk 700	PE 5/16		19	19	10/78	18	5	23	5
	Clerk 800	PE 5/16		25	25	4/79	25	15	40	60
	Clerk 400	Z80		19	19	/80	0	0	0	NA
	Clerk 500	Z80		21	21	/80	0	0	0	NA
	Total						43	20	63	65
Sentinel Computer Corp.	Sentinel	8086		21	38	7/79	33	5	38	450
A.O. Smith *	Mesa Two	Nova 3		58	58	5/77	10	0	10	X
Space Byte Computer	DBM/1	8085		6	13	7/78	55	10	65	X
	DBM/2	Z80		13	15	6/79	10	0	10	73
	Total						65	10	75	73
Span Management Systems*	TSS 2	IBM Series/1		31	31	/77	10	3	13	X
Sperry Univac	BC-7	Univac		22	45	4/77	1,075	460	1,535	1,000
STC Systems, Inc.	Ultimacc 2000	Nova 3/12		34	80	9/72	108	2	110	5
	Ultimacc 3010	Nova 3/D		55	112	1/75	108	2	110	15
	Ultimacc 3080	Nova 3/D		84	143	11/75	25	0	25	20
	Total						241	4	245	40
Tri-Star, Inc.*	TTK-10	Nova 3/12		45	55	2/76	12	0	12	X
	TEK-80	Nova 3/12		52	67	4/76	4	0	4	X
	Total						16	0	16	
Vanguard Computer Systems, Inc.	V 400	Raytheon RDS 500		45	52	6/77	2	0	2	NA
	V 500	Raytheon RDS 500		65	85	3/76	5	2	7	NA
	Total						7	2	9	
Vista Computer, Inc.	VSM	Nova 4		29	29	/80	0	0	0	NA
Wang	2200	2200		10	19	4/73	12,730	8,390	21,120	1,645
	2200 VP	2200 VP		15	21	9/76	2,090	1,620	3,710	1,557
	2200 MVP	2200 MVP		18	36	1/78	1,850	1,310	3,160	2,652
	VS	2200 VS		47	97	10/77	620	380	1,000	771
	Total						17,290	11,700	28,990	6,625
Warrex Computer Corp.	Centurion I-A	CC-205		18	19	/77	60	0	60	X
	Centurion II-A	CC-205		27	30	/75	95	0	95	X
	Centurion III	CC-205		36	36	/74	555	0	555	43
	Centurion V	CC-205		43	43	/75	119	0	119	0
	Centurion Series 100	CC-205		14	15	/79	24	0	24	10
	Centurion Series 200	CC-205		25	28	/79	16	0	16	25
	Centurion Series 6000	CPU 6		18	35	1/80	0	0	0	63
	Total						869	0	869	141
Wintex Computer Corp.	200 NS	Wintex		12	18	1/75	95	1	96	X
	MT 200	Wintex		10	20	10/79	12	0	12	100
	Total						107	1	108	100
Zilog	MCZ 1/70	Z80		18	18	1/80	0	0	0	NA
TOTAL							104,850	62,089	166,939	

Notes:

a) Include installations of Eldorado 140.
b) Used Microdata processors until 11/76.
c) Corporate name changed from Automated Business Concepts, March 1, 1980.
d) Design data was acquired by Data General in February 1977.
e) Digital Computer Controls was acquired by Data General in early 1977.
f) Marketed in the U.S. by Shasta General Systems.
g) U.S. installation figures account for retirements.
*) Not currently active in manufacturing or marketing small business computers.
NA) Data is not available.
X) Model not in new production.

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MINICOMPUTER CENSUS

The categorization of certain computers as "minicomputers" is based on marketplace definitions as perceived by IDC. Minis are general-purpose in design but sold as tools, not just solutions; are available from the makers as complete systems, not just boards; are available to OEMs and usually discounted in volume buys; and are part of a family that has at least one product in the $2,000-$25,000 price range and comes with at least 4K RAM. Size classes are: (S) Supermini; (T) Traditional Mini; (M) Micromini. The heading on the minicomputer census has been changed this year from "Number Installed" to "Cumulative Number Shipped," reflecting the fact no attempt has been made to account for retirements.

AS OF JANUARY 1,1980

NAME OF MANUFACTURER	COMPUTER MODEL	BITS PER WORD	SIZE	PURCHASE PRICE ($1,000) BASIC	PURCHASE PRICE ($1,000) AVERAGE	DATE OF FIRST INSTALLATION	CUMULATIVE NUMBER SHIPPED IN U.S.	CUMULATIVE NUMBER SHIPPED OUTSIDE U.S.	CUMULATIVE NUMBER SHIPPED TOTAL	ORDERS FOR 1980 INSTALLATION
Artonix*	PC-12/7	12	T	20	45	9/71	135	40	175	X
Bytronix	Series 500	16	T	3	4	/80	0	0	0	600
	Series 1000	16	T	5	5	12/77	60	250	310	200
	Series 2000	16	T	8	8	12/78	30	50	80	200
	Series 3000	16	T	7	8	12/78	20	170	190	150
	Total						110	470	580	1,150
Century Computer Corp.	C-200	8	T	5	7	2/71	150	0	150	X
Cincinnati Milacron	CIP/2000 Series	8	T	4	17	7/69	4,650	800	5,450	NA
	CIP/4000 Series	16	T	4	17	12/76				X
Compiler Systems, Inc.*	CSI-16	16	T	11	20	11/70	80	10	90	X
	CSI-24	24	T	15	30	12/70	35	5	40	X
	Total						115	15	130	
Computer Automation, Inc.	108/208/808	8	T	5	11	4/68	280	30	310	X
	116	16	T	8	16	8/70	200	50	250	X
	216	16	T	8	20	7/69	350	45	395	X
	816	16	T	10	15	12/68	40	5	45	X
	Alpha-8, Naked Mini-8	8	T	2	3	5/72	5,002	1,340	6,342	X
	Alpha-16, Naked Mini-16	16	T	3	8	10/71				
	LSI 2/10,2/20,2/60	16	T,T,S	2	5	12/73	18,356	1,942	20,298	NA
	LSI 3/05	16	M	1	2	2/76	1,974	536	2,510	NA
	LSI 4/10	16	M	1	2	6/77	1,422	328	1,750	NA
	LSI 4/30	16	T	2	4	6/77	698	186	884	NA
	LSI 4/90	16	S	4	9	6/77	421	84	505	NA
	Scout Naked Mini 4/04	16	M	0.6	1.0	12/79	NA	NA	NA	250
	Total						28,743	4,546	33,289	250
Computer Talk, Inc.	CT-400	16	S	25	30	9/75	7	0	7	NA
	CT-407	16	S	32	37	12/77	1	0	1	4
	CT-427	8	M	3	6	1/79	0	0	0	0
	Total						8	0	8	4
Control Data Corporation	1700	16+2	S	37	160	3/66				X
	1700-SC	16+2	S	20	60	9/70				X
	System 17	16+2	T	14	39	2/74				
	Cyber 18-10	16+2	T	14	40	/76	1,800	1,215	3,015	NA
	Cyber 18-20	16+2	T	16	75	/76				
	Cyber 18-30	16+2	S	110	116	9/76				
	Cyber 18-5	16+2	T	14	35	/77				
	Elbit-100	12	T	6	8	6/77	5	445	450	X
	Total						1,805	1,660	3,465	
Data General Corporation	MP 100,200	16	M	1	3	/79	400	100	500	650
	MicroNova	16	M	2	4	11/76	3,200	1,250	4,450	1,750
	Nova	16	T	6	12	2/69	750	400	1,150	X
	Nova 2 Series	16	T	3	8	10/73	5,630	1,970	7,600	115
	Nova 3/4	16	T	4	4	1/76	3,800	1,100	4,900	2,185
	Nova 3/12	16	T	5	18	1/76	11,700	5,150	16,850	6,560
	Nova 3/D	16	T	12	36	10/76	1,800	1,350	3,150	1,610
	Nova 4/C	16	T	3	5	/79	700	900	1,600	2,100
	Nova 4/S	16	T	6	16	/79				
	Nova 4/X	16	T	10	33	/79				
	Nova 800/820	16	T	7	34	3/71	2,180	720	2,900	X
	Nova 830/840	16	S	16	43	7/73	660	360	1,020	X
	Nova 1200 Series	16	T	3	11	12/70	8,400	3,450	11,850	X
	SuperNova, SC	16	T	9	27	4/70	300	150	450	X
	Eclipse S/100, 130, 140	16	S	11	30	2/75	3,320	1,150	4,470	1,800
	Eclipse AP/130	16	S	30	50	9/78				
	Eclipse S/200, 230	16	S	15	52	2/75	2,630	900	3,530	575
	Eclipse S/250	16	S	35	100	11/78	60	20	80	40
	Eclipse C/150	16	S	55	102	12/78	110	90	200	250
	Eclipse C/300,330	16	S	24	120	2/75	1,200	300	1,500	350
	Eclipse C/350	16	S	130	180	11/78	360	50	410	490
	Eclipse M/600	16	S	164	210	5/78	270	40	310	290
	Eclipse MV/8000	32	S	153		10/80	0	0	0	NA
	Subtotal						47,470	19,450	66,920	
	DCC-112	12	T	3	12	8/70	700	400	1,100	X
	DCC-116	16	T	5	10	11/71	7,450	1,350	8,800	X
	DCC-416/616	16	T/S	3	7	9/75	125	15	140	X
	DCC-Model 5	16+2	T	3	6	2/76	80	10	90	X
	Subtotal						8,355	1,775	10,130	
	Total						55,825	21,225	77,050	
Datamate Computer Systems*	DM-16	16	T	17	26	11/69	12	0	12	X
	DM-70	16	T	9	15	12/70	25	0	25	X
	ECP-18	18	T	14	16	11/66	21	0	21	X
	Total						58	0	58	
Datum, Inc.*	Enhancer E1/16	16	T	8	15	3/76	15	3	18	X
Digiac Corporation*	3060		T	9	13	1/70	70	20	90	X
	3080	25	T	20	25	12/64	14	2	16	X
	Total						84	22	106	

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AS OF JANUARY 1,1980

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Digital Equipment Corp.	PDP-8/a,e,f,m	12	T	4	15	4/71	33,300	15,450	48,750	7,500
	PDP-8/i,l,s	12	T	8	27	5/65	5,765	3,685	9,450	X
	PDP-9,9L	18	T	35	50	12/66	290	160	450	X
	PDP-11/03, LSI-11	16	M	1	2	6/75	55,150	20,350	75,500	36,000
	PDP-11/23, LSI-11/23	16	M	2	6	/79				
	PDP-11/04,05,10,15,20	16	T	5	17	3/70	26,950	15,050	42,000	5,000
	PDP-11/34,35,40	16	T	9	38	1/73	17,200	11,300	28,500	8,000
	PDP-11/44	16	S	23		/80	0	0	0	500
	PDP-11/45,50,55	16	S	24	89	4/72	3,200	1,350	4,550	400
	PDP-11/60	16	S	26	73	6/77	870	900	1,770	600
	PDP-11/70	16	S	60	167	7/75	5,200	2,300	7,500	2,300
	VAX-11/780	32	S	128	225	5/78	600	250	850	700
	PDP-12	12	T	13	46	4/69	510	255	765	X
	PDP-15, XVM	18	T	15	82	2/70	550	320	870	X
	Total						149,585	71,370	220,955	61,000
Digital Microsystems	HEX-29	16	S	13	22	4/79	6	5	11	50
Digital Scientific Corp.	Meta-4/4000	16	S	29	90	4/70	140	15	155	X
	Meta-4/5010	16	S	21	40	10/78	5	0	5	X
	Meta-4/5020	16	T	25	90	4/78	40	0	40	8
	Meta-4/5030	16	S	53	140	5/79	2	0	2	10
	Total						187	15	202	18
Electronic Associates, Inc.	Pacer-100	16	T	15	40	5/72	155	123	278	NA
Foto-Mem, Inc.*	Centaur-100	8	T	6	20	4/70	25	0	25	X
General Automation, Inc.	GA-18/30	16	S	18	50	7/69	780	210	990	X
	SPC-12	8	T	4	16	1/68	3,250	860	4,110	X
	SPC-16	16	T	5	25	5/70	7,210	1,920	9,130	600
	16/110,220	16	M	1	3	12/75	4,240	1,130	5,370	3,500
	16/330,340	16	T	3	10	1/76	335	90	425	0
	16/440,460	16	S	9	30	7/75	1,710	450	2,160	100
	16/550	16	S	25	50	3/78	9	2	11	600
	230, 240	16	M	NA	NA	/80	0	0	0	NA
	470, 480	16	S	NA	NA	/80	0	0	0	NA
	Total						17,534	4,662	22,196	4,800
GRI Computer Corporation	909 Series	16	T	4	9	1/70	320	150	470	X
	99/30, 38	16	T	5	15	6/72	578	268	846	0
	99/10, 18	16	T	3	5	6/72	24	0	24	NA
	99/40, 48	16	T	6	17	6/72	207	278	485	NA
	99/50, 58	16		6	12	/74	146	44	190	NA
	99/52	16		8	17	/76	7	3	10	NA
	Total						1,282	743	2,025	
GT&E	IS/I	16	T	14	36	1/70	160	40	200	X
	IS/1000	16	T	6	10	6/72	4,000	75	4,075	1,000
	Total						4,160	115	4,275	1,000
Harris	6024/1	24	S	69	135	5/69	21	1	22	X
	6024/3	24	S	49	90	2/70	118	1	119	X
	Slash 4	24	S	24	110	8/73	205	18	223	9
	Slash 5	24	S	16	50	5/72	588	24	612	55
	Slash 6	24	S	20	70	12/76	155	8	163	53
	Slash 7	24	S	45	180	10/75	18	1	19	8
	Series 100	24	S	85	190	10/75	37	1	38	3
	Series 200	24	S	179	240	10/75	43	3	46	4
	Series 1X5	24	S	85	175	9/77	120	22	142	75
	Series 500	24	S	195	300	12/78	72	8	80	125
	Series 800	24/48	S	165	300	6/80	0	0	0	NA
	Total						1,377	87	1,464	332
Hewlett-Packard	2100A	16	T	7	15	6/71	7,900	3,400	11,300	X
	2100 S	16	T	16	36	8/73	1,825	1,425	3,250	X
	2114/15/16	16	T	9	29	11/66	2,495	1,145	3,640	X
	1000-M (MX-M,K)	16	T	2	16	6/74	7,400	5,750	13,150	
	1000-E (MX-E)	16	T	6	22	1/77	4,900	5,600	10,500	8,700
	1000-F	16	T	12	40	9/78	1,150	800	1,950	
	3000 I	16	S	100	200	11/72	1,360	840	2,200	
	3000 II	16	S	100	200	4/76				1,500
	3000 III	16	S	105	200	6/78	590	410	1,000	
	3000-33	16	S	58	135	1/79	230	220	450	500
	3000-30	16	S	50	105	10/79	30	20	50	400
	Total						27,880	19,610	47,490	11,100
HIS-GE/PAC	30	8	T	7	35	5/69	225	50	275	X
	3010, 2	16	T	13	90	5/70	25	1	26	X
Honeywell	112	12	T	5	10	11/69	222	48	270	X
	116/316/416/516	16	T	8	62	10/66	2,405	1,295	3,700	X
	700 Series	16	T	16	65	6/72	1,954	1,531	3,485	X
	164X Series	16	T	144	440	12/69	20	8	28	X
	6/06	16	T	7	42	1/76				
	6/23	16	T	6	25	/78				3,250
	6/33	16	T	4	40	5/78	1,930	780	2,710	
	6/34	16	T	4	18	1/76				X
	6/36	16	T	4	35	1/76				X
	6/43	16	S	7	110	1/77				
	6/47	16	S	19	160	8/78	2,070	1,220	3,290	3,250
	6/53	16	S	19	145	5/78				
	6/57	16	S	44	225	/78				
	Total						8,851	4,933	13,784	6,500
Information Technology, Inc.*	4900/10	16	T	10	20	10/65	25	0	25	X
IBM	Series/1	16	T	5	28	11/76	7,500	3,500	11,000	12,500
Keronix	IDS-16/8	16	T	4	5	4/74				
	IDS-16/10	16	T	3	5	4/74	2,800	250	3,050	320
	IDS-16/12	16	T	3	4	4/74				
Lear Siegler*	VDP-410	16	T	4	4	10/78	100	50	150	X
Lockheed Electronics Company, Inc.	LEC-16	16	T	11	18	3/69	2,590	435	3,025	X
	SUE	16	T	6	11	9/72	2,878	472	3,350	1,000
	Total						5,468	907	6,375	1,000
Microdata Corporation	400	8	T	3	4	1/70	155	0	155	X
	800 Series	8	T	6	11	5/69	2,055	1,380	3,435	X
	1600	8	T	5	11	2/72	9,934	1,836	11,770	1,265
	3200/3230	16	S	8	14	3/74	115	110	225	X
	Micro One	8	M	1	3	11/74	800	120	920	X
	Total						13,059	3,446	16,505	1,265
Minicomp*	MD-708	8	T	5	7	8/70	50	0	50	X
Modular Computer Systems	Modcomp I	16	T	2	9	10/71	698	142	840	X
	Modcomp II	16	T	13	41	3/71	2,118	525	2,643	50
	Modcomp III	16	S	13	44	12/70	72	5	77	X
	Modcomp IV	16/32	S	48	100	5/74	339	130	469	5
	Classic 7810	16	T	8	25	5/79	165	16	181	230
	Classic 7860	16/32	S	38	100	1/78	89	40	129	110
	Classic 7870	16/32	S	64	128	8/78	75	57	132	185
	Classic 7830	16/32	S	29	55	9/79	42	10	52	175
	Total						3,598	925	4,523	755

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Motorola Communications Division*	MDP-1000	8	T	8	19	2/69	75	0	75	X
New England Digital Corporation	ABLE Series 40	16	T	8	10	6/77	100	25	125	25
	ABLE Series 60	16	T	10	12	6/78	75	10	85	25
	Total						175	35	210	50
Omnitec (BIT)*	480	8	T	6	17	12/66	195	3	198	X
	483	8	T	9	33	1/70	115	40	155	X
	Total						310	43	353	
Perkin-Elmer Corporation (Interdata)	1	8	T	4	11	9/70	210	77	287	X
	2,3,4,5	16	T	9	21	5/67	614	153	767	X
	13,15,16,18	16	T	15	33	9/69	14	14	28	X
	50,55	16+1	T	7	33	4/72	133	40	173	X
	70	16	T	9	65	12/71	1,060	342	1,402	X
	74	16	T	3	34	2/73	300	56	356	X
	80,85	16	T	15	50	7/72	70	18	88	X
	5/16	16	M	1	5	1/77	248	67	315	100
	6/16	16	T	2	15	1/76	1,457	642	2,099	400
	7/16	16	T	3	18	2/74	3,673	836	4,509	150
	8/16	16	T	4	25	1/77	357	139	496	250
	7/32	32	S	10	35	7/74	1,177	408	1,585	300
	8/32	32	S	55	160	6/75	556	242	798	200
	Series 16	16	T	5	22	4/79	91	19	110	250
	3220	32	S	34	90	5/79	113	52	165	400
	3240	32	S	85	185	10/79	3	5	8	100
	Total						10,076	3,110	13,186	2,150
Point 4 Data Corporation (a)	Point 4	16		5	7	3/79	350	50	400	1,200
Prime Computer Corporation	100	16	T	6	12	4/73	300	760	1,060	10
	200	16	T	7	22	11/72	420	110	530	10
	300	16	S	12	58	9/73	450	350	800	10
	400	16	S	62	207	6/76	280	120	400	10
	500	16	S	126	330	6/76				
	350	16/32	S	31	116	7/78	80	50	130	200
	450	16/32	S	50	75	2/79	160	100	260	340
	550	16/32	S	70	125	2/79	170	110	280	330
	650	16/32	S	95	165	2/79	20	10	30	100
	750	32	S	130	200	7/79	40	30	70	180
	Total						1,920	1,640	3,560	1,190
Raytheon Data Systems	703	16	T	13	23	10/66	179	33	212	X
	704	16	T	10	18	3/70	700	200	900	X
	706	16	T	19	30	5/69	75	17	92	X
	RDS-500	16	S	17	21	12/73	1,100	225	1,325	NA
	Total						2,054	475	2,529	
Redcor Corporation*	RC-70	16+2	T	15	30	7/68	100	40	140	X
Sperry-Univac	520i	16	T	6	13	9/68	330	170	500	X
	620/a	16	T		75	12/65	120	30	150	X
	620/f, f-100	16	T	10	23	6/70	470	220	690	X
	620i	16/18	T	10	20	12/65	920	380	1,300	X
	620/L + 100C	16	T	5	12	2/71	720	320	1,040	X
	620/L-100	16	T	6	14	6/72	1,091	554	1,645	50
	A620/i, R622/i	16/18	T	15	29	6/69	175	80	255	10
	V-72	16	T	10	45	2/74	990	433	1,423	300
	V-73	16	S	16	45	11/72	1,190	530	1,720	X
	V-74	16	S	40	80	5/74	210	90	300	X
	V-75	16	S	39	80	8/75	120	50	170	X
	V-76	16	S	8	16	1/76	674	309	983	150
	V-77-200	16	M	2	5	1/77	622	216	838	160
	V-77-400	16	T	5	19	12/76	306	230	536	170
	V-77-600	16	S	8	40	3/77	980	243	1,223	340
	V-77-800	16	S	10	50	3/79	18	8	26	400
	Total						8,936	3,863	12,799	1,580
Systems Computer Corp.*	1000	8	T	1	4	1/71	400	200	600	X
Systems Engineering Laboratories	32/30,35	32	S	30	80	9/76	130	30	160	
	32/55,57	32	S	50	125	8/75	510	170	680	250
	32/75,77	32	S	70	150	3/78	260	60	320	
	Total						900	260	1,160	250
Tandem Laboratories, Inc.	T16	16	S	85	130	5/76	592	198	790	NA
Telefile Computer Products	TCP-16/5	16	T	12	17	/77	4	3	7	50
Texas Instruments	960-A/B	16	T	14	30	12/71	3,400	1,600	5,000	NA
	980-A/B	16	S	17	40	10/72	3,450	1,550	5,000	NA
	990/4	16	M	1	8	6/76	6,500	2,200	8,700	NA
	990/10	16	T	20	25	3/76	7,000	2,150	9,150	NA
	990/5	16	M	3	8	3/79	450	150	600	NA
	990/12	16	S	29	70	11/79	25	5	30	NA
	Total						20,825	7,655	28,480	
Two Pi	Two Pi/V32	32	S	125	125	6/78	100	6	106	NA
Unicom, Inc.*	CP-8	8	T	3	8	2/70	343	165	508	X
Unicomp*	Comp-16	16	T	11	29	6/70	26	0	26	X
	Comp-18	18	T	12	38	8/70	38	0	38	X
	Total						64	0	64	
Westinghouse Electric	P-50	14	T	16	23	8/64	182	40	222	X
	P-2000	16	T	10	27	8/69	111	90	201	X
	2500 F	16	T	10	30	11/71	319	115	434	10
	Total						612	245	857	10
Xerox*	CE-16,16/A	16	T	8	23	6/69	35	10	45	X
	Sigma-2	16	T	24	125	12/66	170	80	250	X
	Total						205	90	295	
TOTAL							383,380	157,598	540,978	

Notes

a) Corporate name changed from Educational Data Systems, March 1, 1980.
*) Not currently active in manufacturing or marketing minicomputers.
NA) Data is not available.
X) Indicates minicomputer models not in new production.

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DESKTOP COMPUTER CENSUS

The Desktop Computer Census counts those computers which typically are small enough to be used on a desktop, and are found in a variety of end-user environments including business, home, hobby, personal, educational, and scientific. By IDC definition the Desktop Computer is microprocessor based, includes its own power supply and enclosure, has the capability for attaching output peripherals -- video screen and/or printer -- and can also attach storage devices such as floppy diskettes, tape cassettes, or in some cases fixed disks. The computer is programmable in BASIC or equivalent level language, and costs from less then $1,000 up to $15,000 in a basic configuration. Microcomputer boards and kits are not counted here.

AS OF JANUARY 1, 1980

NAME OF MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	PURCHASE PRICE IN DOLLARS BASIC	PURCHASE PRICE IN DOLLARS AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1980 INSTALLATION
Altos Computer Systems	ACS 8000-6	Z80	9,450	10,000	11/79	150	150	300	2,000
	ACS 8000-2	Z80	4,500	5,000	6/77	1,500	1,200	2,700	5,000
	Total					1,650	1,350	3,000	7,000
APF Electronics	Imagination	6800	600	1,400	11/79	1,000	0	1,000	10,000
Apple Computer Company	Apple II	6502	1,195	2,500	5/77	46,000	12,000	58,000	NA
Associated Computer Industries	ACI 90 System	Microengine	6,695	7,700	6/79	47	200	247	1,594
Atari	400	6502	550	550	9/79	3,000	0	3,000	NA
	800	6502	1,000	1,000	9/79	5,000	0	5,000	NA
	Total					8,000	0	8,000	
BRD, Inc.	Small Fry	6800	7,000	10,000	4/79	50	0	50	NA
CMC Marketing	CMC System 100	Z80	2,930	5,000	1/80	0	0	0	NA
Columbia Data Products, Inc.	500	Dual Z80-A	3,000	3,995	9/79	140	12	152	1,500
	900	Dual Z80-A	4,100	4,995	9/79	50	26	76	
	MX	Z80-A	2,495	2,495	12/79	6	6	12	110
	FX	Z80-A	4,495	4,495	2/80	0	0	0	71
	Total					196	44	240	1,681
Commodore	PET/CBM	6502	795	995	10/77	49,000	58,000	107,000	100,000
Compal	8100	8080	9,775	12,000	10/76	400	0	400	10
	8200	Z80	11,995	14,000	1/80	0	0	0	230
	Total					400	0	400	240
Compucorp	625	Z80	5,000	8,500	6/77	200	500	700	NA
	655	Z80	5,000	7,000	4/79	500	1,000	1,500	NA
	665	Z80	5,000	7,000	4/79				NA
	Total					700	1,500	2,200	
Computer Data Systems	Versatile 4	8085	3,800	4,500	11/77	700	150	850	
	Versatile 3B	8085	4,900	5,500	11/77	250	50	300	800
	Series 80	8085	4,800	12,000	2/80	0	0	0	
	Total					950	200	1,150	800
Computer Hardware, Inc. (Business Machines)	4800	CHI	8,850	8,850	/80	0	0	0	50
Computer Interface Technology	Pense System	Microengine	5,295	8,000	11/79	100	55	155	625
Cromenco	System Three	Z80-A	5,995	10,943	8/77	3,200	300	3,500	NA
Diablo	3000	8085	15,000	17,000	12/79	50	0	50	NA
Digital Equipment Corp.	Mini MINC	LSI-11	9,900	11,000	10/79	80	20	100	500
	Datasystem 150	LSI-11	10,900	15,000	3/79	300	250	550	700
	Total					380	270	650	1,200
Digital Microsystems	DSC-2	Z80-A	4,995	5,895	11/77	3,600	1,250	4,850	8,000
	DSC-2 SBS	Z80-A	9,950	9,950	6/78	250	0	250	400
	DSC-86	Z80-A	5,995		/80	0	0	0	NA
	DSC-86 SBS	Z80-A	12,950		/80	0	0	0	NA
	Total					3,850	1,250	5,100	
Durango Systems	F85	8085A	12,983	13,517	10/78	400	400	800	NA
Dynabyte	DB8/1	Z80	2,295	6,000	/78	817	301	1,118	2,088
	DB8/2	Z80	4,395	8,500	/78	590	207	1,512	1,512
	Total					1,407	508	1,915	3,600
Exidy	Sorcerer	Z80	1,295	2,200	8/78	6,000	6,000	12,000	17,000
Findex, Inc.	100	Z80	4,500	5,980	7/79	24	6	30	700
	128	Z80	8,230	8,980	/80	0	0	0	3
	Total					24	6	30	703
General Robotics*	Polaris	LSI-11	13,000	13,000	4/78	0	100	100	X
Heath	WH89	Z80	2,295	2,500	/79	125	0	125	NA
Hewlett-Packard	9830	HP	4,900	16,500	11/72	5,000	5,000	10,000	X
	9825	HP	5,900	11,000	1/76	22,500	30,500	53,000	
	9835	HP	9,000	13,000	12/78	1,850	2,250	4,100	29,000
	9845	HP	12,000	28,000	11/77	5,500	7,000	12,500	
	Total					34,850	44,750	79,600	29,000
IMSAI*	VDP-40	8085	5,300	5,300	/78	380	20	400	X
	VDP-80	8085	7,800	7,800	/77	670	130	800	X
	Total					1,050	150	1,200	
Industrial Microsystems	5000	8080, Z80	3,300	3,300	6/79	70	50	120	1,000
	8000	8080, Z80	4,700	4,700	6/79	170	110	280	1,000
	Total					240	160	400	2,000
Intelligent Systems	8051	8080A	3,650	4,200	/76	4,900	2,100	7,000	3,000
	8063	8080A	6,200	9,500	11/79				
	3621	8080A	3,300	3,300	7/79				
	Compucolor 2	8080A	1,600	1,800	9/78	2,625	875	3,500	2,500
	Total					7,525	2,975	10,500	5,500

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AS OF JANUARY 1, 1980

NAME OF MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	PURCHASE PRICE IN DOLLARS BASIC	PURCHASE PRICE IN DOLLARS AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	ORDERS FOR 1980 INSTALLATION
Interactive Computer Systems	MCM 900	2901	9,200	20,000	2/79	100	300	400	200
	MCM 800	Bipolar	8,600	17,000	1/77	50	150	200	X
	MCM 700	8008	7,200	12,000	3/75	50	250	300	X
	Total					200	700	900	200
IBM	5100	IBM	6,300	13,000	11/75	4,300	1,000	5,300	X
	5110	IBM	9,900	17,000	2/78	12,500	2,200	14,700	10,000
	5120	IBM	9,340	15,000	2/80	0	0	0	
	Total					16,800	3,200	20,000	10,000
Intertec Data Systems	SuperBrain	Dual Z80-A	2,995	2,995	10/79	800	200	1,000	9,000
	SuperBrain QD	Dual Z80-A	3,995	3,995	4/80	0	0	0	5,000
	Total					800	200	1,000	14,000
Konix International Corp.	System 80	Z80	3,700	4,000	6/78	53	14	67	150
	System 81	Z80	3,700	4,100	1/80	18	1	19	100
	Total					71	15	86	250
Micro V Corporation	Microstar I	8085A	7,500	15,000	8/78	500	500	1,000	1,300
	Microstar II	8086	12,000	25,000	5/80	0	0	0	500
	Total					500	500	1,000	1,800
Micro Applications Systems, Inc.	Mascot System	6802	5,000	8,000	/80	0	0	0	2,000
Midwest Scientific	MSI-6800AW	6800	5,000	11,000	5/79	300	450	750	1,000
North Star Computers	Horizon	Z80-A	2,695	3,350	12/77	8,200	1,800	10,000	8,200
Northwest Microcomputers	NMS 85/P	8085	7,200	7,200	1/78	25	3	28	20
Odell Industries*	System 85	8085A	10,450	15,500	6/78	30	0	30	X
Ohio Scientific	Challenger	6502/6800/Z80	1,260	2,500	/78	2,250	250	2,500	NA
Pertec Computer Corporation	PCC 2000	8085A	9,995	13,120	9/78	700	420	1,120	1,700
	MITS 300/25/55	8080	8,080	13,800	/77	1,100	175	1,275	75
	Total					1,800	595	2,395	1,775
Polymorphic Systems	8813	8080	4,700	5,870	9/77	2,000	300	2,300	700
	Twin Systems	8080	6,000	7,500	/80	0	0	0	65
	Total					2,000	300	2,300	765
Processor Technology*	Sol I/II/III/IV	8080A	3,000	6,000	/77	4,500	500	5,000	X
Psytek, Inc.	Psytek 770	Z80-A	7,250	10,000	7/79	15	5	20	180
Quay Corporation	Quay 900	Z80	4,995	4,995	12/79	75	0	75	450
	Quay 500	Z80	2,500	2,500	3/80	0	0	0	200
	Quay 520	Z80	3,200		3/80	0	0	0	NA
	Total					75	0	75	
RZE of America (U.S. Only)	80/20	Z80	2,000	2,500	9/79	0	-	0	1,000
	80/30	Z80	5,000	7,000	7/79	5	-	5	10
	80/40	Z80	7,000	8,500	7/76	20	-	20	10
	80/50	Z80	12,000	15,000	7/75	5	-	5	5
	Total					30		30	1,025
Retail Sciences, Inc.	Clerk 300	Z80	12,000	12,000	8/79	70	40	110	275
Scientific Data Sys., Inc.	SDS 420 Series	6502	7,900	8,800	3/79	75	15	90	40
S.D. Systems	SDS 100	Z80	6,995	6,995	4/78	500	300	800	NA
	SDS 200	Z80	8,995	8,995	5/77	65	30	95	NA
	Total					565	330	895	
Smoke Signal Broadcasting	Chieftan	6800	2,595	3,000	3/79	300	100	400	800
	Chieftan	6809	2,695	3,100	3/80	0	0	0	NA
	Total					300	100	400	
Solid State Technology	Athena 8285	8085A	8,000	10,000	/79	900	1,100	2,000	2,350
Tandy Radio Shack	TRS-80/I	Z80	499	1,000	9/77	139,500	15,500	155,000	110,000
	TRS-80/II	Z80	3,450	5,000	7/79	5,000	0	5,000	
	Total					144,500	15,500	160,000	110,000
Tano Corporation	Outpost II	6800	3,500	4,909	8/78	500	50	550	NA
	Outpost 7	6800	3,000	4,000	8/77	180	20	200	X
	Total					680	70	750	
Tektronix	4051	6800	5,995	17,000	12/75	7,500	4,000	11,500	NA
Texas Instruments	99/4	TI9900	1,150	1,300	/79	2,000	0	2,000	NA
Vector Graphic	System B, MZ	Z80	4,313	5,400	1/79	2,700	900	3,600	NA
	Memowrite	Z80	8,950	8,950	1/79	300	100	400	X
	Total					3,000	1,000	4,000	
Wang Laboratories	PCS1	Wang 2200	5,400	8,000	4/76	800	300	1,100	X
	PCS2	Wang 2200	4,800	10,145	4/77	2,915	1,885	4,800	NA
	Total					3,715	2,185	5,900	
Zeda Computers International	Zeda 580	Z80	6,837	6,837	6/79	47	3	50	3,000
Zenith	Z89	Z80	2,895	2,895	10/79	1,125	125	1,250	2,500
Zilog	MCZ Series	Z80	6,690	9,000	/77	650	550	1,200	200
	MCZ Series A	Z80	8,460	8,460	1/80	0	0	0	NA
	Total					650	550	1,200	
TOTAL						371,042	164,129	535,171	

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• THERE WILL BE A HOT TIME IN EUROPE AS NIXDORF AND OLIVETTI, armed with U.S.-made IBM plug-compatible systems, attempt to fight the Giant for a larger share of the action. Olivetti has signed with IPL Systems for its machines, and Nixdorf recently announced it intends to play the game all the way, buying The Software Company; Nixdorf is mum on the source of hardware.

• AND FUJITSU ESTABLISHES BEACHHEAD WITH TRW in the U.S. A joint venture pact calls for TRW-Fujitsu to market systems from point of sale up through general purpose Fujitsu CPUs. Under the agreement, TRW will phase out of making point-of-sale and financial DP gear by about 1983 and 1987, respectively; these will then be supplied by Fujitsu. The agreement does not cover gear that Fujitsu sells on an OEM basis to Amdahl and Memorex. Fujitsu also OEMs to Siemens. Fujitsu in Japan supplies a full range of CPUs that are compatible with IBM gear. Thus it looks like the States will have another PCM vendor. For the moment, however, the company says it will supply small business systems with Fujitsu's V-830. In 1979, Fujitsu gained 15% of its $2.1 billion revenues from export sales.

• LOCAL LOOPS HEAT UP WITH DEC, INTEL AND XEROX JOINING forces on a scheme based on Xerox's Ethernet to locally link different kinds of equipment. Looks like Xerox contributes Ethernet, DEC processors, and Intel custom chips. The group is open to specification suggestions, but indicated the net will operate at 10M bit/sec on coaxial cable up to 500 meters long. Not much has been heard of IBM's loop scheme unveiled with the 3630 plant system, but that or a close cousin might show up in the Panther, which is supposed to be IBM's update of the OS/6, which probably has a variation of Wang's word processing software. Remember the license trading pact between Wang and IBM? Both firms are mum, but word has it Wang swapped its WP software in return for IBM's bubble technology. Wang has plans to work on speech technology -- hopefully dictation into a terminal is coming soon. Not quite a local loop, but another means of short haul communications, infrared, is expected to be one of the highlights at IBM's booth at the NCC held adjacent to Disneyland.

• AMDAHL HAS OKAYED MARRIAGE WITH STORAGE TECHNOLOGY, although the hardest part seems seems to be finding a name for the new entity. The 1979 combined earnings were $56.9 million (EDP/IR April 14) and revenues $779 million.

• DATA GENERAL LAUNCHES EAGLE 32-BIT MINI, DEC ADDS VAX SOFTWARE. DG's entry in this arena is the MV 8000, which has multiple caches, busses and microprocessors. The system has processors for central processing, system control and I/O, which has 64K of local memory. There's a 16K system cache as well as a 1K instruction cache. Maximum main memory is 2M. Taking a page from DEC's handbook, there isn't a 32 bit Cobol as yet, which indicates DG intends to sell it to the scientific mart first. Prices start at $153K for a bare-bones system with no software, $257K for a medium-scale with AOS/VS and a language. AOS/VS is due by the end of the year. First deliveries are scheduled for October, 1980. DEC recently upgraded its VAX 11/780 operating system to handle 4M of multiport memory in addition to 8M of local memory and endowed it with 32 bit Cobol and Basic and better data retrieval and forms generation. These supermini shipments to the commercial market should pick up. Although there are other VAXs installed in Beta sites, DEC is mum.

• HAPPY NCC -- Apple Computer hosted attendees to a night at Disneyland.

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